The Welding Engineer

Reg. U. S. Pat. Office

Founded by L. B. Mackenzie, 1916

SEPTEMBER, 1927 — VOL. 12, No. 9

$3.00 per year in U. S. — 608 S. Dearborn St., Chicago, Ill. — $4.00 per year abroad

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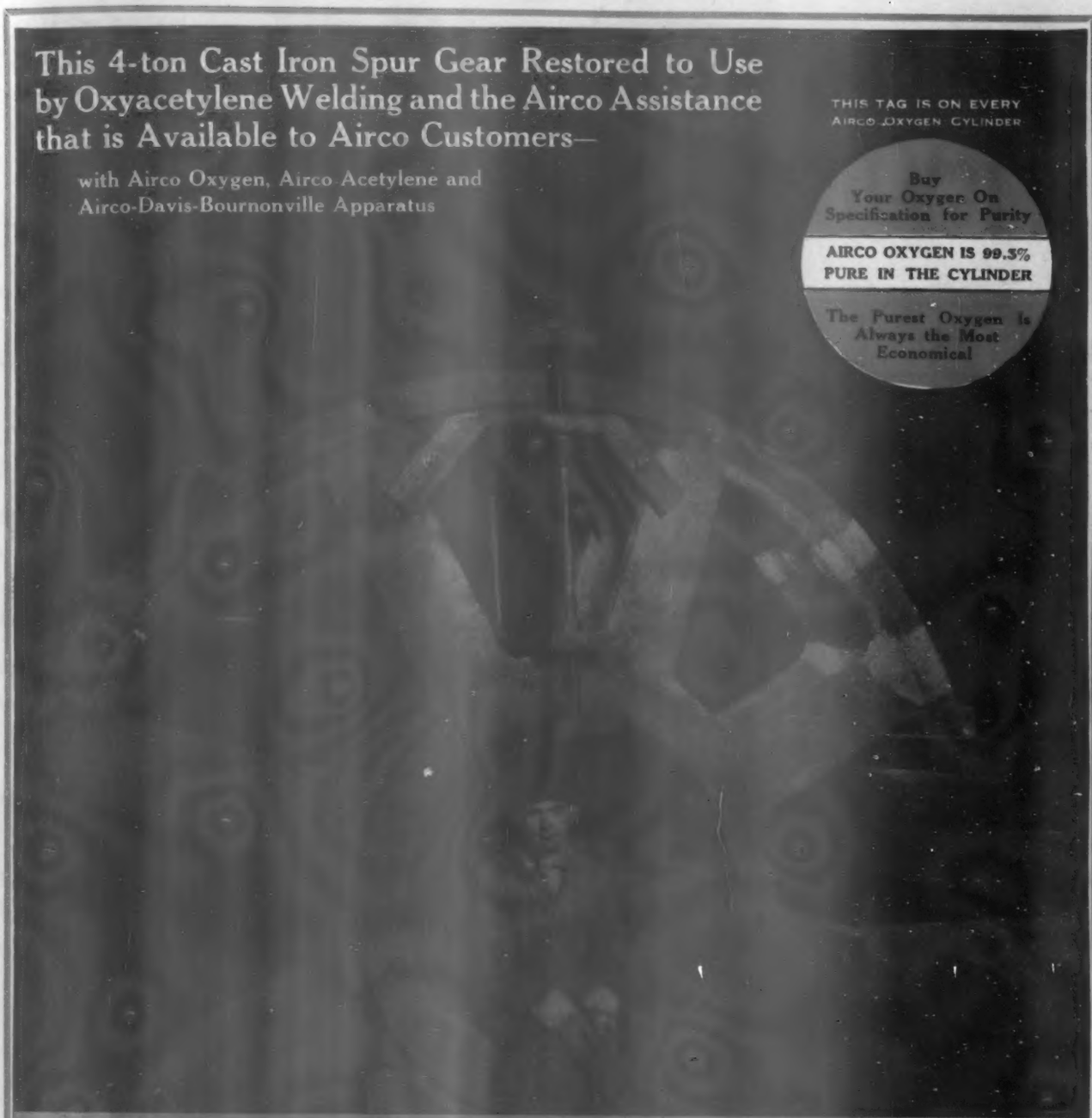
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The Welding Engineer

Founded by L. B. Mackenzie, 1916

Volume 12 | September, 1927 | Number 9

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Keep Up With the Procession

WITH a reputation built up through years of manufacturing high-grade merchandise to maintain, and competition which floods every promising looking market to meet, the modern factory is obliged to be alert for every improvement in production methods. Processes which may be unsatisfactory in the early stages of development quite commonly respond to engineering study and turn out to be an actual necessity when finally perfected. Especially is this true of the welding processes, because they are among the most modern developments in metal working. Equipment is available today for performing welding operations which were rightfully considered impracticable twelve months ago. Still, research engineers tell us that this work on the perfection of apparatus and materials has not come within sight of a stopping place. This means that month after month will see new problems solved and new economies made possible for production engineers. In every metal working plant someone should keep constantly in touch with the announcement of the manufacturers in the welding industry.

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The Welding Engineer does not publish in its news or advertising columns any matter that deals with or refers to either personal or legal controversies.

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Buyers' Index

Readers of The Welding Engineer will find this index to contain the most accurate information obtainable relating to welding apparatus and supplies. The advertising section includes the principal manufacturers of the United States.

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Air Reduction Sales Co.
Commercial Acetylene Supply Co.
International Oxygen Co.
Prest-O-Lite Co.

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Wodack Electric Tool Corporation..... 61

PORTLAND
Oregon or Maine

A CONTINENT lies between them, but, as far as Union Carbide is concerned, Portland, Oregon, and Portland, Maine, are next door neighbors.

Orders for Union Carbide received today from Portland, Oregon, and from Portland, Maine, will be delivered at each place within twenty-four hours.

This kind of delivery service is made possible through the Union Carbide warehousing system. Union Carbide is quickly available from more than 190 warehouses located at strategic points throughout the country.

UNION CARBIDE SALES COMPANY
Unit of Union Carbide and Carbon Corporation
Carbide and Carbon Building, 30 East 42d St.
New York

UCC

PEOPLES GAS BLDG.
Chicago, Ill.

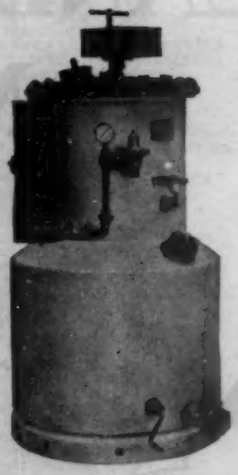
ADAM GRANT BLDG.
San Francisco, Cal.

Union Carbide Warehouses in 190 Cities

WELDERS

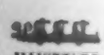
LEAD BURNERS

REGULATORS



SPECIAL BURNERS

TANK VALVES


MANIFOLDS

Acetylene Generators

(U. S. MODEL)

THEY ARE:—Efficient; sturdily built; simple to operate; of long life; tried and proven thru years of usage; are available at greatly reduced prices in sizes of 20, 30, 50, 100, and 200 pound capacities, stationary or portable type.

THEY WILL:—Insure gas supply; furnish pure acetylene, hence better welds; decrease welding costs to a marked degree—Write for catalog.

ACETYLENE GENERATORS

GASAVERS

COMPLETE OUTFITS

GENERATOR OUTFITS

THE HARRIS CALORIFIC COMPANY

"The Most Complete Line in America"

2828 Washington Ave., Cleveland, Ohio

With which is now merged the U. S. Welding Co., formerly of Minneapolis, Minn.

AUTOMATIC TORCHES

CUTTERS

PREHEATERS

HOLLUP

Arc Welding Machines
Arc Welding Accessories
Arc Welding Wire

Manufactured by

C. H. Hollup Corporation

3333 W. 48th Place **CHICAGO**

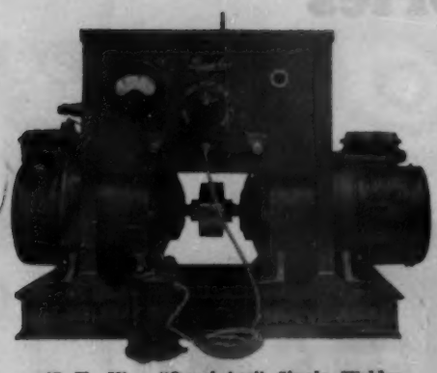
Arc Welding Specialists

See our exhibit National Steel Machine Tool Exposition DETROIT Convention Hall Booth 172

Exclusively engaged in the manufacture of arc welding equipment and a complete line of welding wire for different purposes. In addition, the C. H. Hollup Corporation offers a competent engineering service by a staff of specialists thoroughly experienced in all practical applications of the process.

"Known throughout the World, and used for Rivetless Construction by the leading engineers, industrial corporations, and shipbuilders everywhere"

Quasi-Arc



45 K. W. "Quasi-Arc" Single Welder Motor Generator Set, Type "S"

Quasi-Arc equipment is designed to meet with any shop requirements, and is characterized by high efficiency, which means low costs. Manufactured in single and multiple units for D. C. and A. C.

Quasi-Arc is the scientifically designed Electrode which renders the fusion process uniform and easy to operate, and deposits a pure, homogeneous, fine grained metal of high physics, resisting shocks, vibrations, heat and corrosion practically in the same degree as the constructional steel.

Quasi-Arc welded JOINTS are therefore to be calculated for high stresses, thus reducing the area of section of joint and of construction material, and consequently—

Quasi-Arc welded CONSTRUCTIONS are low in weight and manufacturing costs, as well as unexcelled in quality.

Quasi-Arc speeds up PRODUCTION with no increase in labor and equipment, thus lowering overhead cost percentage and upbuilding your reputation.

SERVICE

Quasi-Arc Service means: Instruction of your operators in the correct application of the Electrodes and periodical supervision.

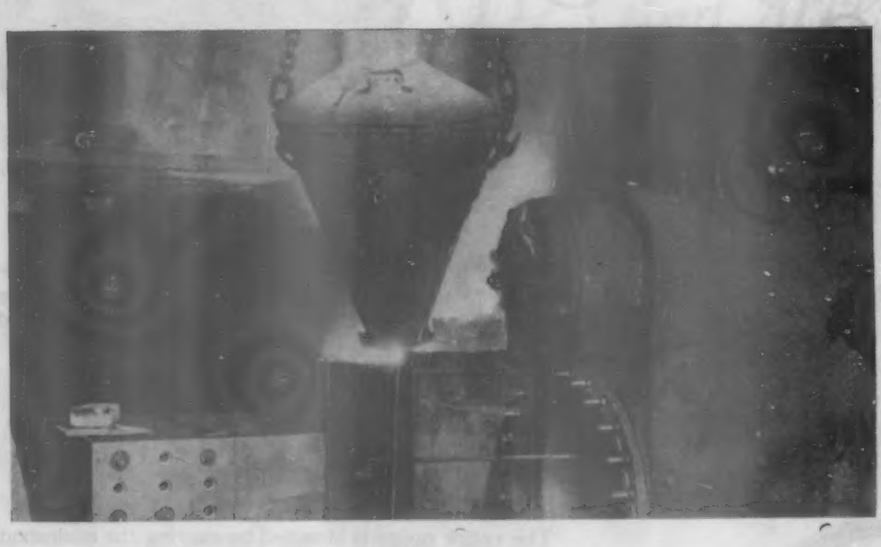
GASHOLDERS WELDED WITH "QUASI-ARC" ELECTRODES

QUASI-ARC INCORPORATED

11 WEST 42nd STREET

NEW YORK

THERMIT WELDING



SINCE the introduction of Thermit Welding, exhaustive research has steadily improved Thermit Steels giving to this process a finished weld possessing all the desired characteristics and finer qualities of the best forged steel. As a result there is practically no medium or heavy size section of iron or steel which when broken does not permit of Thermit Welding as the most economical method of permanent repair.

This constant improvement in the Thermit process of welding has developed tremendous savings in time, labor and material, making it decidedly cheaper in the end.

Write for complete data

THERMIT

METAL & THERMIT CORPORATION
120 BROADWAY . NEW YORK, . N.Y.
BOSTON CHICAGO PITTSBURGH SOUTH SAN FRANCISCO TORONTO

Announcing

the New 300 Ampere Single Operator

Welding Set

Wide Welding Range

From 75 to 400 amperes. This increased capacity enables operators to handle heavy work in addition to ordinary welding jobs.

Liberal Rating

Has a definite rating of 300 amperes for one hour, high continuous capacity.

Simple Control

The entire range is obtained by varying the excitation with a single rheostat handle.

Linestart Motor and Linestarter

A simple, efficient and economical combination. Just push the button and the Linestarter functions, the motor starts up, and the machine is in operation.

Striking and Maintaining Arc

The generator builds up the voltage across the arc gap quickly, and the proper welding current is established instantly when the electrode is withdrawn, after contact is made. This feature assists the welder in establishing a steady arc and maintaining it continuously.

High Efficiency

This machine has high efficiency over the entire welding range.

Westinghouse Electric & Manufacturing Company
East Pittsburgh Pennsylvania
Sales Offices in All Principal Cities of the United States and Foreign Countries

Visit Westinghouse Exhibits

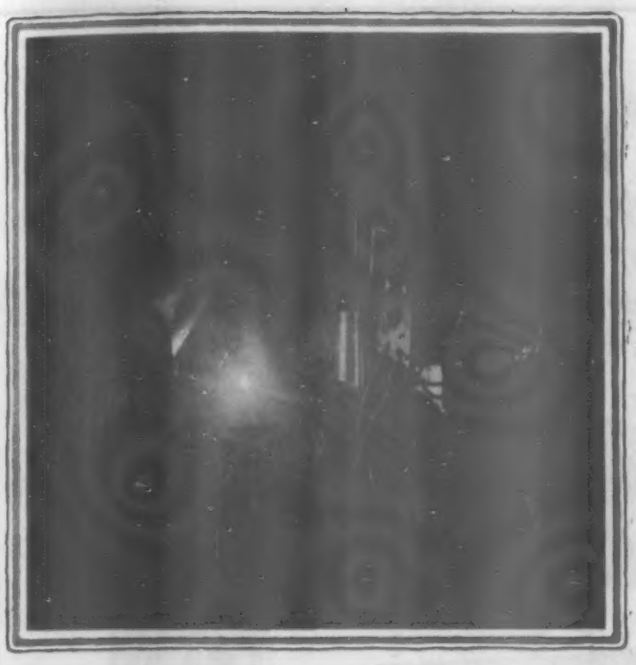
at the National Steel and Machine Tool Exposition at Detroit, Sept. 19 to 23, Booths 123 and 144.

Also

our exhibit at the Machine Tool Builders Exposition at Cleveland, Sept. 19 to 23, booth No. 327.

Westinghouse

X94955



G-E Welding Machines

G-E Welding Electrodes

G-E Welding Accessories

from power line to bead!

General Electric can supply you with everything you need from the time you tap on to the power line until the product is finished. Complete service—another argument in favor of the already highly popular G-E Welding Electrodes.

Type "F" is a bare wire treated by a special General Electric process to obtain a stable concentrated arc. It is used for general welding of steel.

Type "B" is best for automatic welding. The concentrated arc confined by encasing the flux around the core in a sheath, gives remarkable penetration for higher speed welding.

Type "A" is recommended for cast iron.

In absolute reliability of operation and over-all efficiency, G-E Arc Welders are unequalled. They are available in all sizes, all types—for either hand or automatic operation—for one or more operators.

Special distributors for G-E Welding Electrodes located throughout the country are equipped to give you prompt service. Get in touch with the G-E Welding Electrode Distributor near you or write to the Merchandise Department, General Electric Company, Bridgeport, Connecticut.

550-20

GENERAL ELECTRIC

MERCHANDISE DEPARTMENT, BRIDGEPORT, CONNECTICUT

Press the button and this

Heavy Duty Butt Welder

completes the cycle automatically

A butt weld eighteen inches long and one-half inch thick, made in a few seconds, independently of manual control!

Type 110 Heavy Duty Rim Welder. Maximum Capacity 18"x½". 200 K. W. Flashproof Transformer. Air operated clamps. Mechanical push-up.

For many years, both the manufacturer and users of resistance butt welders have recognized the desirability of eliminating all manual labor in operating these machines.

As pioneers in the development of this class of welding and after continued experiments we designed the heavy duty rim welder illustrated.

After the work has been automatically clamped in the welding jaws, press the starter button. The motor makes a complete cycle, while the automatic controller instantly starts at the required time and place, producing perfect uniform welds at a remarkable saving and time.

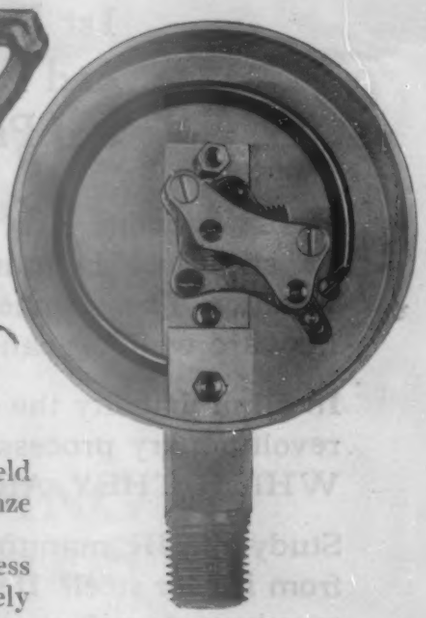
See OUR EXHIBIT NATIONAL STEEL & MACHINE TOOL EXPOSITION DETROIT CONVENTION HALL Sept. 19 - 23 BOOTH No. 152

Federal

Machine & Welder Co.
Warren, Ohio, U. S. A.

Recognized leaders in the development and production of all types of production welders.

"Runnin' Wild"—an attractive bronze by Frederick Willard Potter, famous Western sculptor.



Enduring Bronze

Because the principal working member of every Natweld Gauge—the Bourdon spring—is made of enduring bronze and is thus not subject to rust or corrosion—

Because that bronze spring is treated by a special process that causes it to remain accurately flexible over an extremely long life-period—

Natweld Gauges are reliable under the most severe conditions of service.

A decade of successful performance inspires confidence in such a product. And the user need not pay a premium for that confidence, for huge production, plus volume sales have made possible very reasonable prices.

The Moto-Meter Co. of Can. Ltd., Hamilton, Ontario
Chicago Office: 820 Tower Ct.
Represented in Illinois, Indiana, Wisconsin, Minnesota and Missouri
By Joseph Halla, Chicago, Illinois

The National Gauge and Equipment Co.
La Crosse, Wisconsin
A Division of the MotoMeter Co., Long Island City, N. Y.

NATWELD GAUGES

Prizes for Thinking

Who Will Win Them?

1st Prize	- -	**$10,000**
2nd Prize	- -	**$ 5,000**
3rd Prize	- -	**$ 2,500**

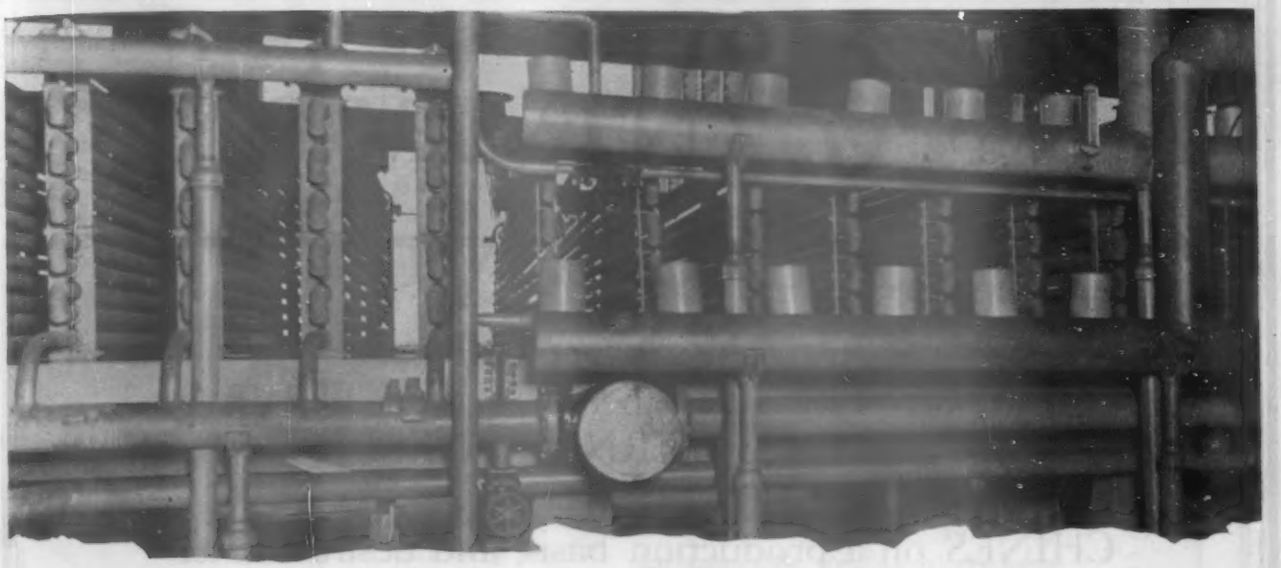
THE Lincoln Arc Welding Prizes for 1927 are offered to stimulate thought along the line of new applications of arc welding. These prizes will be won by men who demonstrate how arc welding can be made of greater benefit to humanity.

In all probability the successful contestants will show how this revolutionary process can be utilized on the very jobs WITH WHICH THEY ARE FAMILIAR.

Study YOUR manufacturing problems. Do you manufacture from iron or steel? If so, arc welding can undoubtedly be utilized to reduce manufacturing costs. In general, the cost of machinery can be reduced 20% or more by this process.

Determine what the total annual saving would be if everyone in your line should adopt arc welding. Then you have the basis of a paper to submit for the arc welding prizes. The winners of these prizes will reap rewards far in excess of the amounts of the awards, for they will be brought to the attention of every mechanical engineer and manufacturer in the United States.

A booklet containing complete information regarding this contest can be secured from The American Society of Mechanical Engineers who will judge the papers. Address them at 29 West 39th St., New York City, or write direct to The Lincoln Electric Company, Cleveland, Ohio.



6,293 Perfect Welds-- on one job!

They were welded with--

Meco WELDING TORCHES

Approved by The Underwriters

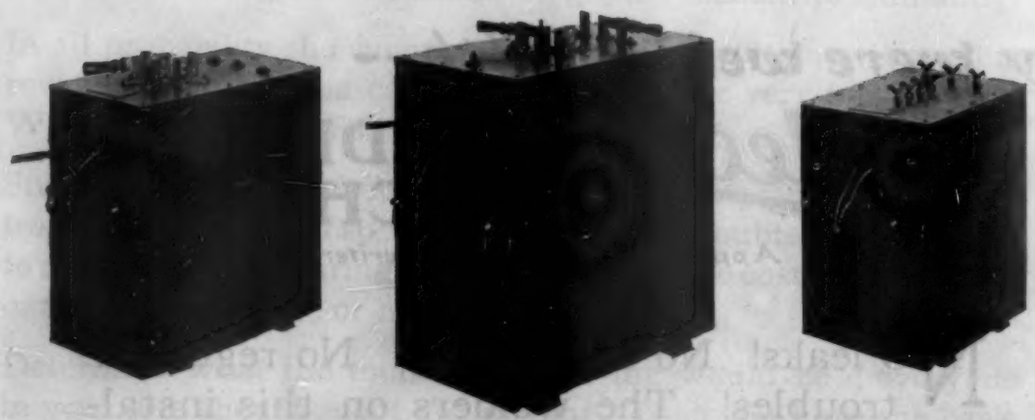
NO leaks! No tip troubles! No regulator troubles! The welders on this installation just went ahead and made good welds as a matter of routine. Every size from half inch pipe to a sixty inch tank was included. MECO apparatus performed perfectly for them and will perform the same way for you.

MODERN ENGINEERING CO.
3411 Pine Boulevard
St. Louis, Mo.

Sales and Service in All Parts of the United States
Write for the Address of Our Nearest Representatives

ANNOUNCEMENT

We are now in position to MANUFACTURE the OWEN line of ALTERNATING CURRENT TRANSFORMER ARC WELDING MACHINES on a production basis, and desire connection with RELIABLE concerns, who are in position to finance an AGENCY, DEMONSTRATE, and PUSH the SALES of the APPARATUS.



TYPE A. H. D.
50 to 200 Welding Amperes
Weight, approx. 290 lbs.
Size, 12"x20"x22"

TYPE U-O
50 to 300 Amperes and up
Weight, approx. 375 lbs.
Size, 14"x24"x26"

TYPE A. M. D.
Equipped with Studs and Nuts Instead of Rotary Switch
50 to 150 Welding Amperes
Weight, approx. 190 lbs.
Size, 12"x18"x20"

Owen Electric Manufacturing Company
Fayetteville, North Carolina

To the WELDING INDUSTRY

WE HONESTLY BELIEVE THAT

"RACO" WELDING RODS

ARE THE FINEST QUALITY RODS ON THE MARKET TODAY

WE manufacture bare electric welding rods of both Pure Iron and Mild Steel analysis. We do not recommend bare rods for electric welding. We believe that the manufacture of a good electrode only starts with a bare wire. However, as large quantities of bare electrodes are used throughout the country, we supply them to those who desire this class of material.

We believe our oxy-acetylene welding rods are the most perfect rods of this type on the American market. They are manufactured from steel and iron made expressly for the purpose. These wires are drawn and copper coated under the direct supervision of our Wire Drawing Superintendent, who has been drawing this type of wire for twenty-five years in France, Italy and Switzerland. The extremely high quality of material used and finish make it a pleasure to use "RACO" gas welding rods.

For electric welding we recommend Raco Composite Electrodes. These rods are used equally well with either A. C. or D. C. current. This rod was originally developed for automatic welding where bare wire will not function due to great speed in welding and high amperage used. The Composite Rod is recommended for all work where bare and covered electrodes have previously been used. Greatly increased speed and far better penetration is secured and absolute uniformity of rods throughout an order is absolutely guaranteed. A special flux of truly wonderful characteristics is inlaid in the lengthwise grooves the entire length of the wire. The flux is protected in the grooves and cannot chip out, even when the wire is bent flat against itself. The accurate depth of the grooves automatically regulates the correct amount of flux needed.

The Composite Wire is furnished on reels for automatic arc welding and will give perfect results under special conditions of high speed and high amperage. The flux in the grooves contains a high percentage of titanium and will weld Cast Iron with better results than any electrode on the market today.

Our Company specializes in drawing welding wire only. We have no other interests and can give our welding rods our undivided attention.

Raco Welding Rods are fairly priced and we are able to give real service from our new plant at Dundalk, Maryland.

REID-AVERY COMPANY, INC.

MARSHALL E. REID, President.

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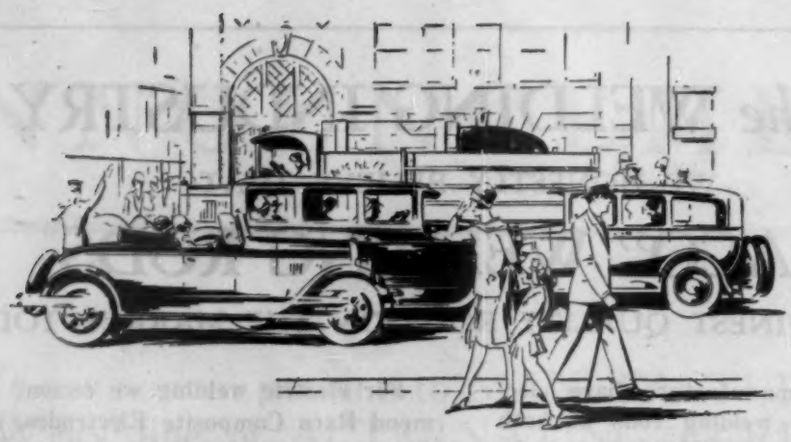
21st and Washington Ave.
PHILADELPHIA, PA.

Works:
DUNDALK, MD.



The Next Logical Step — More Arc Welding!

Arc welding is now used in the manufacture of these cars.

Auburn	Marmon
Buick	Nash
Chevrolet	Oakland
Chrysler	Overland
Dodge	Packard
Essex	Pontiac
Ford	Reo
Graham	Studebaker
Hudson	Willys-Knight
Lincoln	Whippet

These are some of the parts welded:

Rear axle housings	Pistons
Propeller shafts	Spring supports
Front frame cross tubes	Head lamps
Steel wheels	Head lamp tie-rods
Hubs	Engine covers
Shock absorbers	Door frames and hinges
Spark plugs	Generator frames
Mufflers	Connecting rods
Bodies	Accessories

Practically all of these applications have been pioneered by General Electric. Are you using the combination of G-E welders, G-E electrodes, and G-E welding service to cut production costs? You will find your nearest G-E office invaluable in meeting your welding requirements.

530-29

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN PRINCIPAL CITIES

WELDIT GASAVER

gives
30% more welding from each tank of gas.

Hang the torch on the hook —the flame is out.

Lift the torch from the hook —pass the tip across the pilot—you have the same pre-adjusted flame.

You don't have to use costly gas and time getting a neutral flame

The WELDIT GASAVER

saves that useless cost.
One flame adjustment lasts all day.

IT'S A SAFETY DEVICE, TOO!

An automatic check valve keeps flashbacks from reaching hose or regulators.

WELDIT ACETYLENE CO.

634 Bagley Ave. **DETROIT, MICH.**

The GASAVER
can be used with any type of apparatus.
Approved by
National Board of Underwriters

Welding Torches
Cutting Torches
Regulators
Lead Burning Equipment
Welding Wire
Welding Goggles
Cast Iron Rods
Welding Hose
Brazing Wire
Fluxes and Solders
Safety Gloves
Service

See OUR EXHIBIT NATIONAL STEEL & MACHINE TOOL EXPOSITION DETROIT CONVENTION HALL BOOTH

National Carbon Products for Electric and Gas Welding Operations

For Gas Welding

National Welding Carbon Products are highly refractory and are designed to withstand the extreme temperatures encountered in gas welding operations. National Welding Carbon Blocks, Rods, Paste and Flour are very desirable for all gas welding operations requiring the use of molds, cores or dams for the protection of all parts requiring shielding from the heat of the torch.

For Electric Arc Welding

National Welding Electrodes have been designed especially to meet the requirements of all electric carbon arc welding or cutting apparatus. Whether you work with a large or small current, there is a National Carbon Electrode which will give you complete satisfaction.

There are also National Welding Carbon Blocks, Rods, Paste and Flour for molds, cores or dams in all arc welding processes.

Write us explaining your production problems or construction jobs. The use of National Carbon Products may help considerably in making these operations more efficient. Our sales engineers are at your service.

NATIONAL CARBON COMPANY, INC.
Cleveland, Ohio San Francisco, Cal.
Unit of Union Carbide and Carbon Corporation

Emergency Service Plants

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7th Floor, Arrott Power Bldg. No. 3
Barker Place
Phone: Atlantic 3570

NEW YORK, N. Y.
357 West 36th St.
Phone: Lackawanna 8153

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SWEDOX

WELDING RODS, WIRES and ELECTRODES

SWEDOX Welding Rods and Wires, differing widely in chemical and physical properties, have one common quality. Each brand is made for a particular welding requirement.

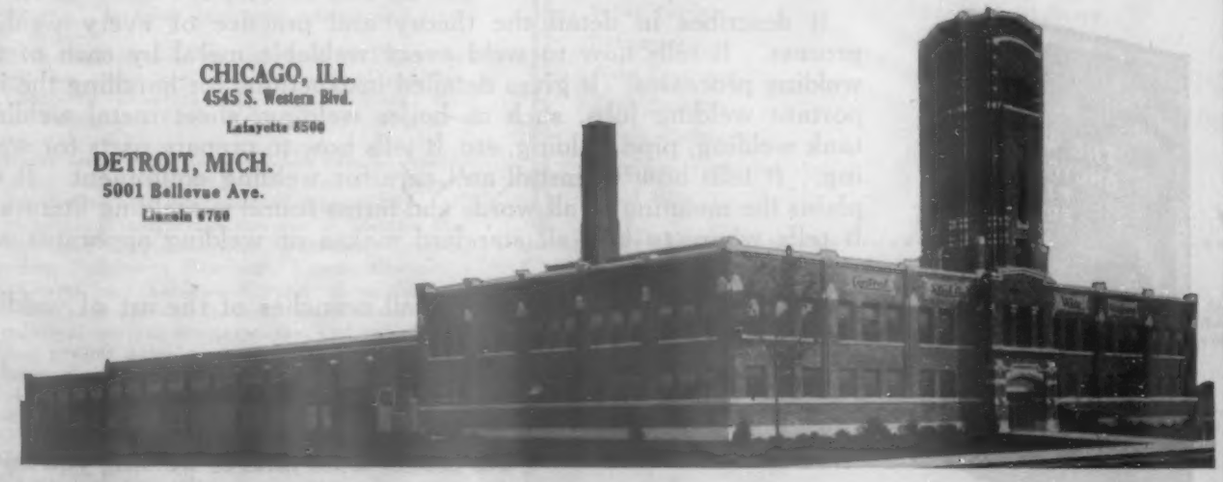
When you consider the care that must be exercised in the selection of metal for different construction requirements, it becomes apparent that equal care is necessary in selecting filler material for welding the joints in these constructions.

The SWEDOX line has been developed so as to furnish on each welding job the welding wire which will enable the welder to get the most satisfactory result. There is a SWEDOX wire for your work. Try it, and you'll know why SWEDOX customers come back.

Central Steel & Wire Company

CHICAGO, ILL.
4545 S. Western Blvd.
Lafayette 8500

DETROIT, MICH.
5001 Bellevue Ave.
Lincoln 6780



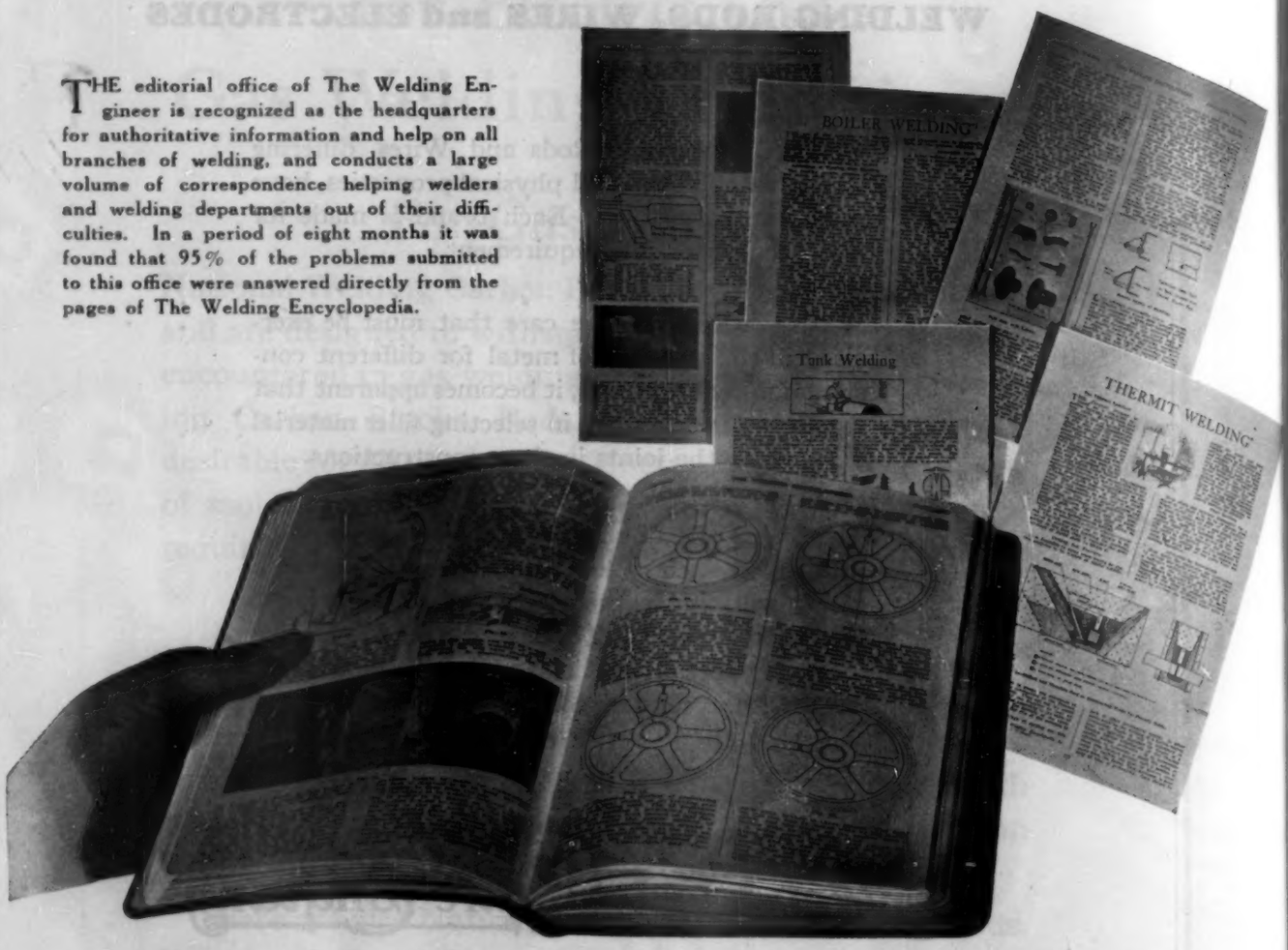
Main Warehouses and General Offices, Central Steel & Wire Co., Chicago.

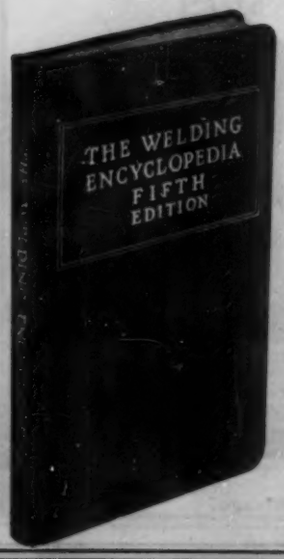
If you Weld, you need—

The Welding Encyclopedia

Fifth Edition

THE editorial office of The Welding Engineer is recognized as the headquarters for authoritative information and help on all branches of welding, and conducts a large volume of correspondence helping welders and welding departments out of their difficulties. In a period of eight months it was found that 95% of the problems submitted to this office were answered directly from the pages of The Welding Encyclopedia.





It describes in detail the theory and practice of every welding process. It tells how to weld every weldable metal by each of the welding processes. It gives detailed instructions for handling the important welding jobs, such as boiler welding, sheet metal welding, tank welding, pipe welding, etc. It tells how to prepare parts for welding. It tells how to install and care for welding equipment. It explains the meaning of all words and terms found in welding literature. It tells where to buy all standard makes of welding apparatus and supplies.

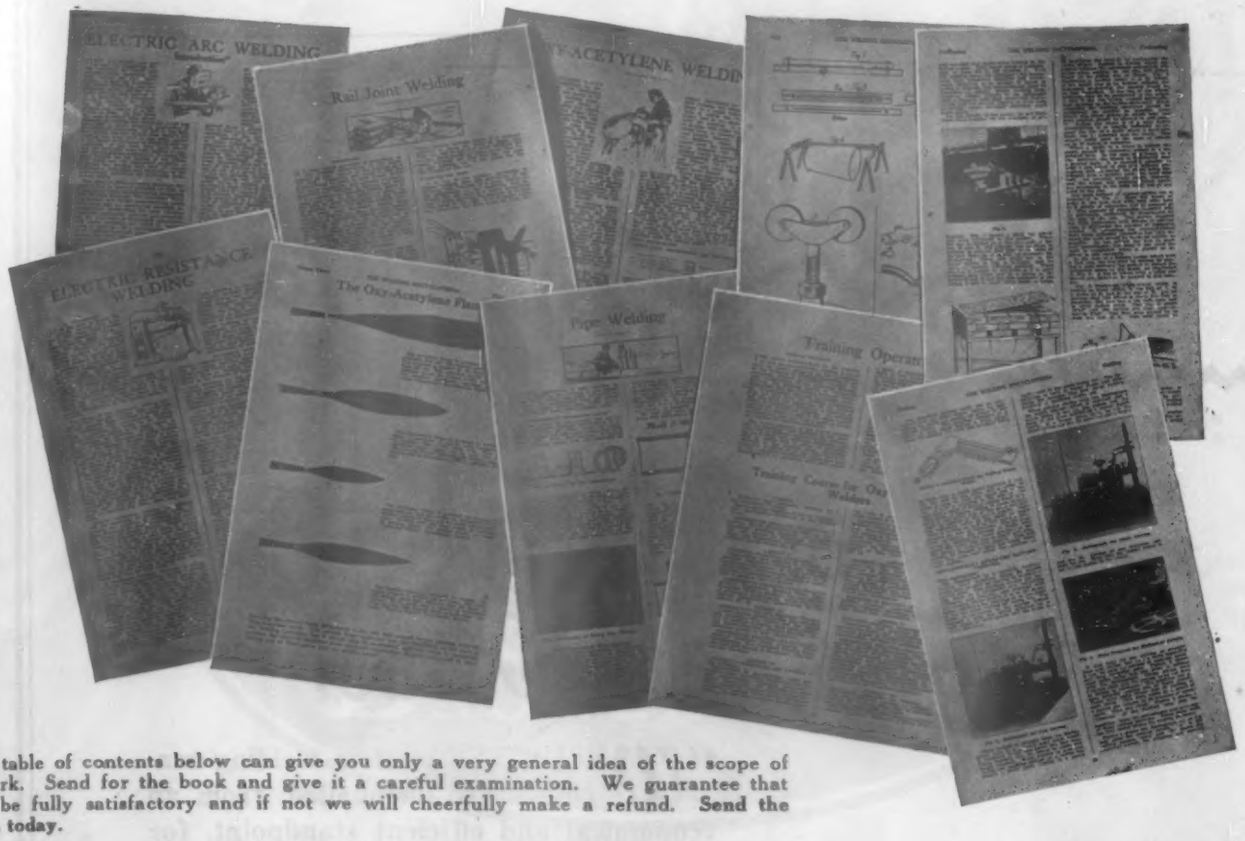
It is the only book that covers all branches of the art of welding completely—

No matter how much welding you do—

No matter what welding process you use—

No matter what kind of welding you do—

Use the Coupon!



The table of contents below can give you only a very general idea of the scope of this work. Send for the book and give it a careful examination. We guarantee that it will be fully satisfactory and if not we will cheerfully make a refund. Send the coupon today.

479 Pages ***625 Illustrations*** ***Price $5.00***

Contents

1. Illustrated encyclopedia covering all words, terms, and trade name's used in welding.
2. Oxy-Acetylene Welding.—Aluminum, Steel, Cast Iron, Brass, Bronze. (Full instructions for welding each of these metals.)
3. Electric Arc Welding.—Complete instructions for welding all metals, studding, cutting, etc.
4. Electric Resistance Welding.—Includes Butt Welding, Line Welding, Percussion Welding and Spot Welding.
5. Thermit Welding.—The most complete treatise on this process ever published.
6. Cutting Metals.—Treatises on both gas and arc cutting. Includes cast iron cutting and automatic cutting.
7. Boiler Welding.—Gas and Electric Processes. Suggestions, procedure, and standards of practice.
8. Complete chapters on Pipe Welding, Rail Joint Welding and Tank Welding, explaining procedure in detail.
9. Rules and Regulations.—What can be welded and what cannot be welded. Rules also govern the installation and operation of equipment.
10. Complete instruction courses in Electric Arc Welding and Oxy-Acetylene Welding. Lessons, Exercises, Reference Readings, Examinations.
11. Charts and Tables—A fund of welding information at a glance. Includes color chart showing colors at various temperatures, and color chart showing proper adjustment of oxy-acetylene welding flame.
12. Condensed Catalogs.—Up-to-date information about the leading makes of welding apparatus and supplies. The Buyers' Index is a convenient and reliable guide to the man who purchases or recommends welding apparatus.

The Welding Encyclopedia is Used by:

Welding Shops	Lumber Companies
Garages	Ice Plants
Boiler Shops	Power Plants
Round Houses	Auto Body Works
Car Shops	Ornamental Iron Works
Scrap Yards	Sheet Metal Shops
Refineries	Shipyards
Auto Factories	Gas Plants
Tank Builders	Foundries
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THE WELDING ENGINEER PUBLISHING CO.,
608 S. DEARBORN ST., CHICAGO, ILL.

Please send me a copy of The Welding Encyclopedia, Fifth Edition, for which find enclosed five dollars. I understand that I may keep it for five days for examination and if it is not satisfactory I may return it and you will refund the purchase price.

Name .....

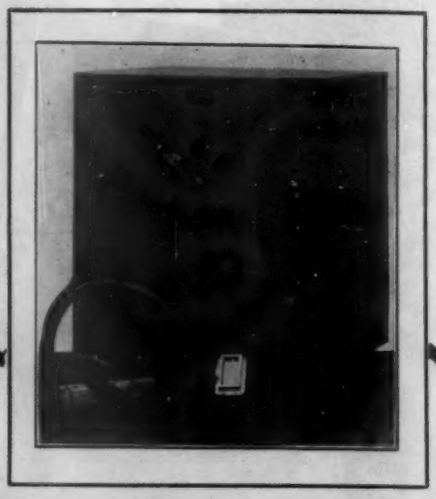
Street .....

Postoffice .....

The New

WELDRITE

TRADE MARK REGISTERED



—the perfect welder

"WELDRITE" electric welding machines are unequalled, from an economical and efficient standpoint, for the welding of flat, vertical or overhead welding of steel, the salvaging of gray iron, steel, chilled or malleable castings, and general plant maintenance.

The efficiency of the "Weldrite" is due to the eighteen controlled heat ranges and the fact that this machine develops the Intermittent as well as the continuous arcs.

Let us convince you of the superiority of the "Weldrite" machines by an actual demonstration on your work and in your own plant which entails no obligations till the merit of these machines have been proven.

Write for our catalog for complete information.

THE ELECTRIC WELDING MACHINE CO.
1530 E. LARNED ST.
DETROIT : : : : MICHIGAN
Canadian Plant: Walkerville, Ontario

WELDRITE Electrode Holder
TRADE MARK REG.

Perfect contact and durability are assured in this electrode holder by the Bulldog grip of the removable jaws, the insulation which prevents annealing of the spring, a special cable connector (which eliminates soldered joints) and the well ventilated light fibre handle. Liberal discount to jobbers in quantities.

The Electric Welding Machine Co.,
1530 E. Larned St.,
Detroit, Mich.

Gentlemen: We are interested in handling the "Weldrite" products in the territory noted below and would like you to submit your proposition.

Name .....

Address .....

Territory Desired .....

Let Us Send You A Free Sample of

Mueller
WELDING
BRONZE ROD

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EDITORIAL

Non-Ferrous Metals Have Several Advantages

WHILE many of the non-ferrous alloys are more expensive, as far as base price is concerned, than the different grades of iron and steel, nevertheless production departments in many of the metal working industries are constantly experimenting with these expensive metals because so many of them have advantages which outweigh the consideration of first cost. At a meeting of the Institute of Metals, which was held this month in England, Dr. Aitchison of Birmingham pointed out that the non-ferrous metals and alloys are only needed when they can offer certain chemical or physical properties that are required by the engineer and that are not possessed by iron and steel. Usually their properties are high resistance to corrosion, high thermal or electrical conductivity, or low specific gravity. In some cases such properties as the ease of machining or cold working is a contributing factor to their choice. The different coppers and copper alloys are good examples of choice where high electrical conductivity is desired. There are also many cases where copper and its alloys are chosen on account of their resistance to corrosion. The alloys of aluminum find their way into a great many types of construction where lightness is desired. To make all these different metals of the utmost practical use it is necessary that they compare favorably with iron and steel in weldability. It has been thought in the past that some of them were not easily adapted to the different welding processes but in many cases a systematic series of experiments has developed welding methods which are entirely satisfactory. Welding is beginning to play such an important part in factory processes that this development of ways and means to weld all non-ferrous metals is very important to the people who intend to use them.

Good Welders Want Good Jobs

MEN who are in close touch with employment conditions are quick to sympathize with good welding operators who try to work toward a better break for themselves. In two or three localities they have formed organizations whose chief function is to identify the grade of work which individual members are capable of doing, using real systematic tests to prove their skill. It is the best basis for organizing which they could select, even though it is recognized that in some welding operations they are handicapped by the heavy assessments made upon them in closed shops. Nothing is so harmful to the interests of the welders as the indiscriminate method of picking men which some employers adopt. It results in poor welding, inefficient operation, and a corresponding low wage scale. An organization which is rigid in its examinations can soon win recognition for its certificates of proficiency, and the services of its members will surely be in demand. Success, however, depends wholly upon how rigidly such examinations are conducted. Only a few cases of ill-advised leniency would be sufficient to render the whole procedure worthless to employers and employees alike. Such an organization is much like a welding department of a large manufacturing plant. There are some of these whose reputation is so good that a welder having worked a year in one of them is accepted as an expert in that class of work. Many employers have welcomed the idea of being able to find out who the welders are who are up to the standard. It will be interesting to watch the progress of these various groups, to note how their standards are maintained, and what effect it all has on improving welding practice generally. Assuming that a man who carries a certificate of good workmanship can get a better pay than one who is unable to have his ability certified, it would seem natural that the second worker should look around and discover his faults and deficiencies, correct them, and get in line for the same pay enjoyed by his more skillful fellow. And it would be a blessing to superintendents to be able to pick the good welders out of a crowd without either guessing or testing or "trying fifty to get three good ones."

A Chance to Pick the Right Process

AS the plant executive goes through the exhibits of welding at Detroit this month he begins to realize that welding isn't the process that the garage man uses to fix his fender, or the process that some folks say will replace riveting on sky-scrapers, but that it is a great variety of processes with a greater number of possible combinations. He may learn that an ice cream can is started on an automatic arc welder, then passed to an oxy-acetylene welder, and finished on a resistance seam welder. Or, that a single unit of gas service station equipment is started on a spot welder, passed through two different seam welders and another spot welder and finally finished by a gas welder. Two tanks looking very much alike are made, one entirely by seam welding, and another by a combination of gas and arc welding. Welding appears in an altogether different light. Last fall, at Buffalo, a young engineer remarked, "I will have to look into this more carefully, for I can see that I am going to have to use it." More like him will be at Detroit, where the display promises to be bigger and better than ever. It is safe to prophesy that more plants will install welding on a production basis as a result, and be able to do it intelligently because executives have had an opportunity to see all the different processes in action, practically

Not Quite Up-to-Date

TRAVELERS enjoy the modern steel railway coach because of the feeling of safety it inspires, as compared to its more fragile antecedent of wood construction. There is still something lacking, room for improvement. In conformity with regulations made for wooden coaches the steel ones carry an axe and saw for use in case of accident. In clearing away wreckage of steel equipment these tools will do in a day what an oxy-acetylene cutting torch would do in a few minutes, so they are better than nothing. But some day a railroad will set the style in supplying trains with fast steel cutting apparatus, just as a few cities have supplied it to fire departments, and travel will be made another bit safer. side by side.

Welding Makes Flying Safer and Better.

IN A large plant where welding is the keynote of all fabrication work there is a great deal of welded equipment which in many places would be of riveted construction. The owner says that his men work better around such equipment because they know how strong welding is and are not so sure of riveted construction. There is a bit of humor in this remark, yet such confidence is not so far-fetched as some of the riveting cohorts would claim. A glance through an article scheduled for early publication in a technical journal discloses some remarks about welding made by a famous airplane builder. He states that men fly better in welded aircraft because they have such complete confidence in its strength and safety. The economies realized through welded construction, and there are several of them, seem to be of small importance compared to the fact that the use of welding results in a better structure. A number of cases on record of forced landings have furnished evidence that even under these extraordinary conditions the welded planes have stood the test.

96 years of Oxweld service

THE OXY-ACETYLENE process of welding and cutting is a recent industrial development. And yet the Oxweld service men alone represent an actual total of 96 years of Oxweld service. Their welding experience is greater even than this, for every one of them was an expert welder before he was selected for the Oxweld service staff.

In addition, there are many in the Oxweld sales organization who started as Oxweld service men and who have all the added ability that this implies.

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Economical Cutting Methods

Some Means of Mechanical Control Will Increase the Efficiency of Their Operations

THE adoption of welding as a means of fabricating in an increasing number of large plants, substituting rolled steel for iron castings, has given rise to the problem of most economically cutting the steel plates, bars, angles, channels and beams to size and shape. To gain the maximum benefits obtainable from the substitution of welding for other methods of joining members of a machine, tank, automobile body, or other metal product, some means must be employed to cut these members quickly and accurately. The oxy-acetyene torch has been found to be by far the most satisfactory tool for this purpose, particularly where

Fig. 1—A Simple and Efficient Cutting Machine for Cutting Steel Plate to Any Pattern Without a Template.

irregular shapes are required or where very heavy material must be cut.

Large scale production called for a still more rapid and economical and more nearly automatic method than by the hand-operated torch. Plants that have been accustomed to reducing costs and speeding up production by replacing hand labor by machines naturally considered the possibility of mechanically controlling the speed and direction of the cutting torch. A number of cutting machines, based on various principles of mechanical control, some quite elaborate and others simpler in design, some using a template and others not, have been developed, resulting in greater speed and accuracy in cutting steel plate of any thickness, as well as in economies in materials used.

The consumption of oxygen is about the most important factor in cutting, as engineers and plant managers are always on the watch for information that will enable their operators to cut down oxygen consumption without cutting down production. It has been proved time and again that it can be easily done if the heads of departments would compel their operators to follow the instructions supplied by the manufacturers of the equipment with each torch. Each size tip is so drilled that it operates at its highest heat efficiency if the pressures are used as prescribed. For each thickness of metal to be cut the instructions tell what size tip and pressure to use and at what speed the torch should travel. This isn't guess work, but the result of thousands of experiments.

It does not take long for a hand cutting operator to get into a rut. Instead of trying to do his cutting with the least amount of oxygen, he will put into his torch a tip three or four sizes too large for the thickness to be cut, and use an oxygen pressure absolutely out of proportion to what he should use, just because it was easier. This is the chief cause of oxygen waste. It requires a given amount of oxygen to consume or oxidize a given amount of steel, and if a greater amount of oxygen is used without additional weight of steel, a waste of oxygen is the result.

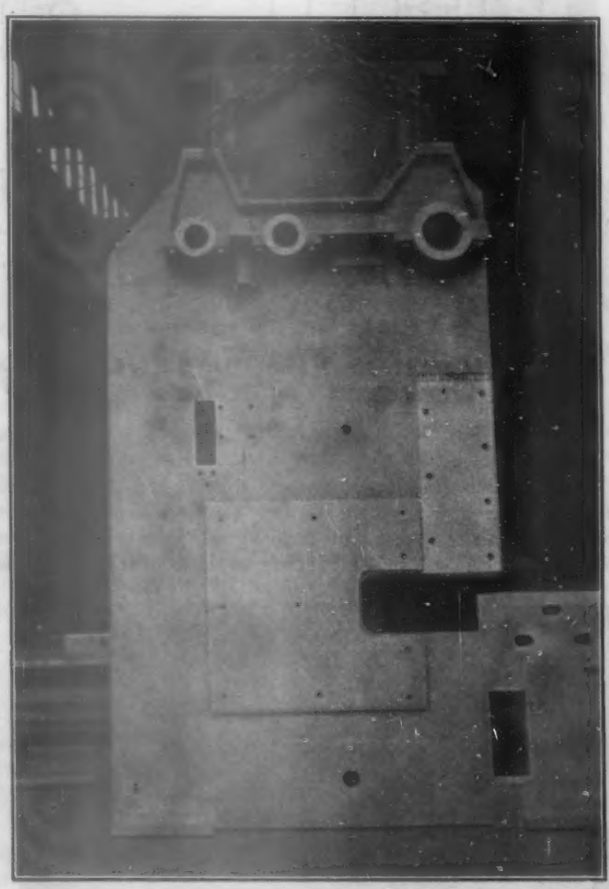


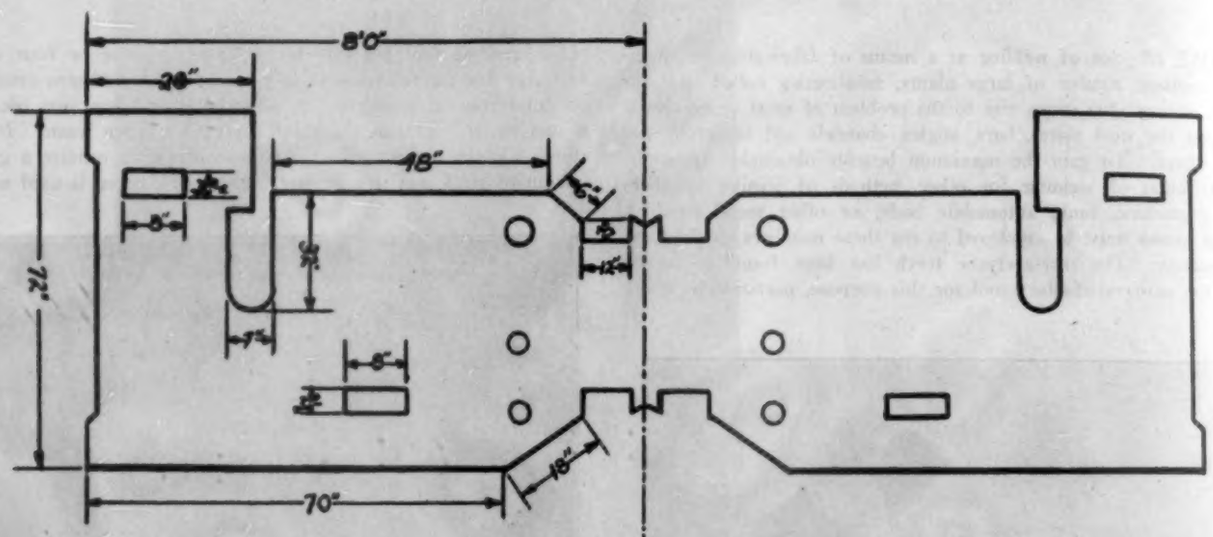
Fig. 2—End Housing Cut From 1¼-inch Plate in Less Than Two Hours With Torch.

In commenting on the savings effected by the use of mechanically operated torches. The Welding Encyclopedia describes one hand cutting test in which 5,000 linear feet of ½-inch plate was cut, covering 17 days at eight hours per day or 136 hours.

"This time covers moving from one side to the other, but does not include changing of cylinders, as a 10 cylinder manifold was used, cylinders being changed before starting in the mornings. Three different size tips were used at varying pressures, but the best results were obtained with the smaller tip. The best day's cutting was used, which was 393 linear feet cut, 565 cubic feet of oxygen consumed. This means his best average linear feet cut per hour was 49 feet. The speed of cutting averaged 8.16 inches per minute, and oxygen consumption 1.43 cubic feet per linear foot.

"To give an idea as to what the human element actually means in hand operation, on one of the seventeen days having the same

identical working conditions and the same thickness of plate to be cut, weather conditions also good, the operator cut as low as 258 linear feet, another day 298, another day 347, and another 360. This proves that a hand operator cannot keep up a constant speed several days at a time.



BOTH END HOUSINGS FOR SQUARING SHEAR CUT FROM ONE 1¼" PLATE WITH TORCH IN 3½ HOURS. STRIP 12' X 13" TO 25" SAVED FOR OTHER PARTS.

Fig. 3.

"In machine cutting tests, the same size tip and lower oxygen pressures were used, using half inch plate, each plate 12 feet long, and obtaining a speed of 18 inches per minute and oxygen consumption 1½ cubic feet to each 18 inch of cutting. The

Fig. 4—Sample of Two-Inch Plate Cut Accurately With Torch, Leaving Smooth, Narrow Kerf.

width of cut was ⅛ inch, and as one square foot of ½ inch plate weighs 20 pounds and dividing this into ⅛ strips we find that we have 96 strips; dividing this into 20 pounds we find that we have oxidized .21 pounds of steel with each cubic foot of oxygen consumed, which is close to the figures given in the report. All of the machine cuts were smooth and straight. 2,500 linear feet were cut by machine."

One of the industries in which such a device is of the utmost importance is the manufacture of heavy machinery, where the cutting of heavy plates, beams, and other shapes presents difficulties of no small proportions. To meet their own requirements, the Kutscheid Manufacturing Company, manufacturers of shear housings, have produced one of the simplest of these machines, principally for use in their own plant in cutting steel plate of thicknesses ranging from ⅛ to 3 inches.

With this device which is not designed to cut a curved pattern, no template is required. The pattern is simply drawn on the plate itself, the machine is set so that the tip of the torch is about ¼ inch from the plate, and by turning one handwheel for longitudinal and the other for lateral movement, the pattern is followed accurately, leaving a very narrow and uniform kerf, which is never more than ¼ inch for 3 inch plate. Any pattern, however intricate, can be easily and quickly cut with this means of controlling the torch. The edge of the metal cut is so smooth as to require practically no tooling or grinding.

For cutting plate up to ½ inch, No. 1 tip is used, with pressures of 2 lb. for acetylene and 20 lb. for oxygen. Thicknesses up to 1¼ inch require a No. 2 tip and 35 and 4 lb. pressure. For 2-inch and 3-inch plate No. 3 tip is used, with pressures of 50 and 5 lb. These pressures compare favorably with those usually recommended for cutting with the hand-operated torch.

With the movement of the torch mechanically controlled, the 3-inch plate can be cut at a steady rate of 5 inches a minute, and the 1-inch plate at the rate of one foot a minute. This speed of cutting, combined with the very narrow kerf and the smooth edge, in most cases requiring no machining, gives a most efficient and economical method of cutting steel plate of almost any thickness to an exact pattern. The principle of this machine can be extended to accommodate plate of any dimension simply by providing beams long enough to take care of the necessary lateral and longitudinal travel of the torch.

Another feature which adds to the adaptability for any requirements is the swivel joint by which the torch is attached to the beam, allowing the edge to be cut at a bevel of any angle. The construction of the machine is so simple that there are few parts to get out of order, and at the same time it is substantially made to withstand the rough handling such a machine is likely to

receive on this work. Every part is visible, making it an easy matter to secure accurate adjustments.

The machine consists of a steel beam, made in any desired length, to which is geared an aluminum carriage, movable to any position on the beam by means of a handwheel. With this arrangement the operator moves along with the torch and can watch the cutting closely. On the carriage is mounted a protruding arm which swivels to any angle. The torch is moved laterally along the arm by means of the smaller handwheel. This combination of movements, together with the arrangement for cutting bevel, permits very accurate control of the cutting.

An excellent example of the saving in time possible by using a mechanically operated cutting torch is found in the end housing for power-driven square cutting shears manufactured in this plant. The two end housings, one of which is shown in Fig. 2, formerly required three days of cutting and machining from 1¼-

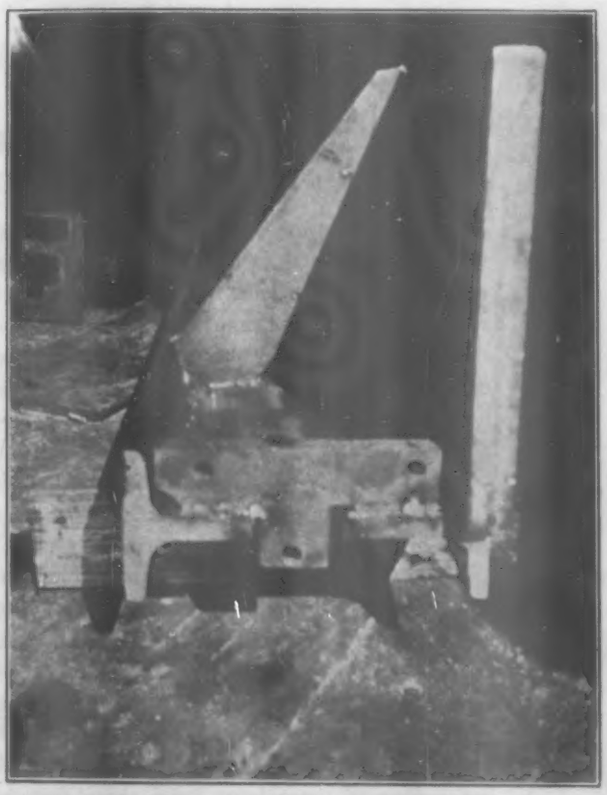


Fig. 5—Members Forming Bed of Shear Quickly Cut to Shape From I-Beams With Mechanically Operated Torch.

inch plate. Both housings are now cut from one plate with the torch and then cut apart at the top, as shown in the drawing, in three and a half hours, including all handing, and they require no machining of the edges. There is a considerable saving in pattern costs as well as in cost of handling, in addition to the direct saving on cutting labor and maintenance of equipment. There is over 100 feet of cutting on each one of these plates, including holes which would be difficult to cut by any means but an acetylene torch.

There are a number of other parts on these shears where a means of rapid and accurate cutting greatly facilitates production. The end view of the bed of the shear (Fig. 4) shows how one flange of an I-beam has been cut off along the full length, and several cuts made on a smaller I-beam to form a very strong welded connection between the larger beam and the bed plate. The time required for the cutting of these parts with the torch is simply a matter of minutes.

NEW JERSEY WELDER HAS GIVEN STRUCTURAL WELDING A START

While there has been considerable mention, in stories and advertisements, of different kinds of structural steel welding which have been accomplished in the Metropolitan district of New York and in New Jersey, there has been little mention of enterprising welders who have contributed a great deal of effort to the pioneering work in these applications. The accompanying photograph shows three portable Alternac sets used by the Helwig Welding Company, 1374 Springfield Avenue, Irvington, New Jersey, a firm

These Three Portable Welders Are Kept Busy.

that has had a great deal to do with the starting of welding on steel roofs. Mr. Harry G. Helwig, manager of the company, has been very active in the promotion of welding for this work and has built up his business to the point where he keeps two welding sets in his shop and three busy on the outside. He tackled some of the largest jobs right at the start and proved on them that arc welding is cheaper than riveting or bolting on these structures. Some work of this sort was done for the United States Gypsum Company, to whom a great deal of credit is due to following the suggestions of Mr. Helwig after he had proved the case of welding for them. The results have been profitable not only to the welding shop and its customers but to the industry in general, for they have shown that on such structures welded joints are not only reliable but are real money savers.

THAWING HYDRANTS WITH THERMIT

The New England Water Works Association has been experimenting with thermit as a means of thawing frozen hydrants. The results of various tests are described in the June issue of Water Works.

The cities of Manchester, Claremont and Concord each furnished three hydrants of various designs for the tests. These were erected at the Concord water works, filled and frozen. Six of these were set wholly above ground and three were placed as they would be in service.

Two methods of thawing were tried: One using a shell containing thermit which was designed to be placed inside the hydrant and melt its way down through the ice; the other consisted of torch containing a special thermit mixture which was designed to apply a flame directly to the outside of the hydrant, or to the interior. This flame enabled heat to be applied directly on the surface at a temperature of 5,000° F.

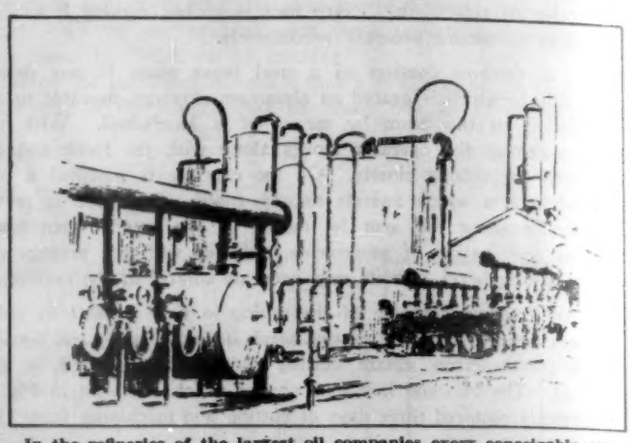
The experience with the interior melter showed some difficulties which necessitates further studies.

The thermit torch was applied above the surface of the ground on the exterior of the hydrant. Before the heating, these hydrants could not be opened, but in a little over a minute they were readily opened and put in working condition. The hydrant to begin with was solidly frozen and the ice extended probably considerable distance into the ground.

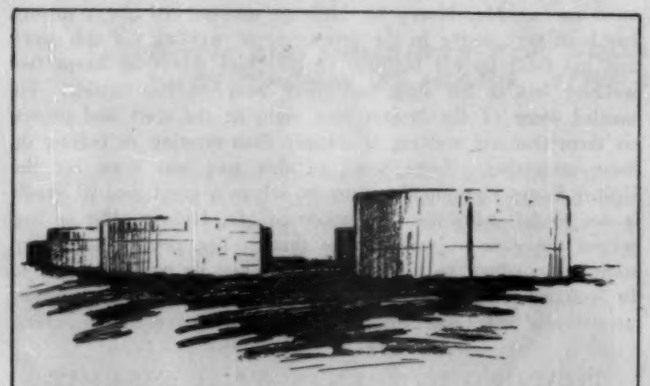
This method of thawing seems to promise such good results that further experiments should be made.

It is well to mention that no injury of any kind to the hydrant was noticed by the use of these methods.

Hundreds of miles of oil carrying pipe line have been laid on a single job without a single failure. Welded lines are so free from leaks that patrol inspection is usually considered unnecessary.



In the refineries of the largest oil companies every conceivable combination of pipe shapes, in equipment operating at high pressures and temperatures, is faultlessly made by fusion welding.



Roofs and bottoms of the largest field storage tanks in the world have been successfully welded, and it is not considered impossible that such tanks can be welded throughout in the future.

Welding for a time was largely a repair process as far as well drilling tools and machinery were concerned. Now it is used extensively in the production of such equipment.

Oil Industry Ke ps

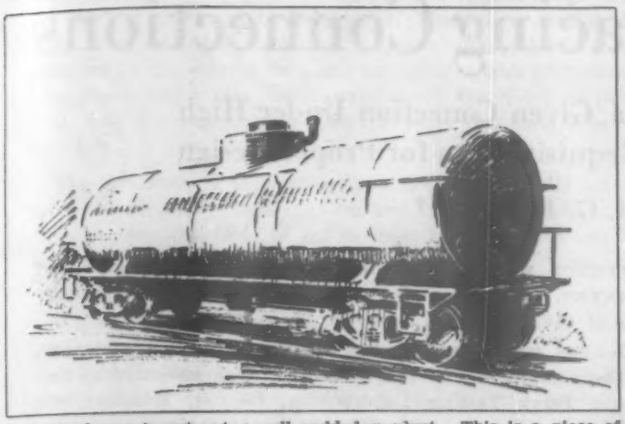
The Great Savings Made by Wel , for tribute Oil Products, Can Be In ased

FROM the time when the oil driller starts boring through the soil to the fluid fortune beneath, until the refined gasoline is delivered to the welded gas tank of the welded pleasure or commercial car, the oil itself is continually passing from one welded article to another. The entire oil industry, and very many of the industries, if not all of them, responsible for the tremendous consumption of oil and oil products, are dependent upon fusion welding for serviceable and economical equipment.

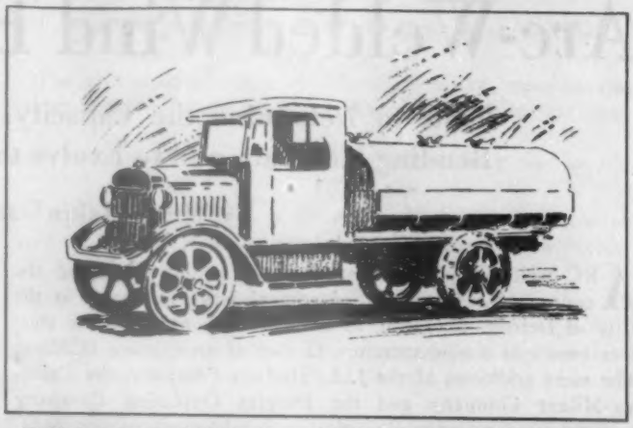
The most important thing that welding has done for the oil industry is to cut down enormous waste through leakage which was the rule before the application of welding to tank and pipe line construction was brought to its present state of perfection. Next in importance is probably the improvement in refinery equipment which welding has made possible.

In the history of the past services which the oil producing and refining industry has received from the welding processes there have been some failures and some dissatisfactions, and some of the welding done at present for the benefit of oil companies and their distributing agencies is noticeably below standard, enough so to keep many buyers in doubt as to the value of the welded product. This is not the fault of welding, but the fault of plant executives who are willing to sacrifice quality in order to reduce manufacturing costs unnecessarily, or who undertake to operate welding departments without proper knowledge of how to use the equipment. The oil industry can obtain welded equipment with all the qualities claimed for it by taking steps to encourage quality work.

But even though this great industry has increased its volume of welding by leaps and bounds during the past few years without definite standards of workmanship, failures of any consequence have rapidly become so rare as to be almost negligible. A question worth considering is whether or not they could not be eliminated entirely



The tank car is not yet an all welded product. This is a piece of construction which offers huge possibilities for cooperative work between the welding industry and the oil industry.



Welded seams in tank trucks resist the stress of constant vibration on the road and prevent leakage of oil in transit. Much of the framework and other parts of these cars now depends on welding.

ps Welders Busy

, for Men Who Produce and Dis- sed by Standardizing Procedure

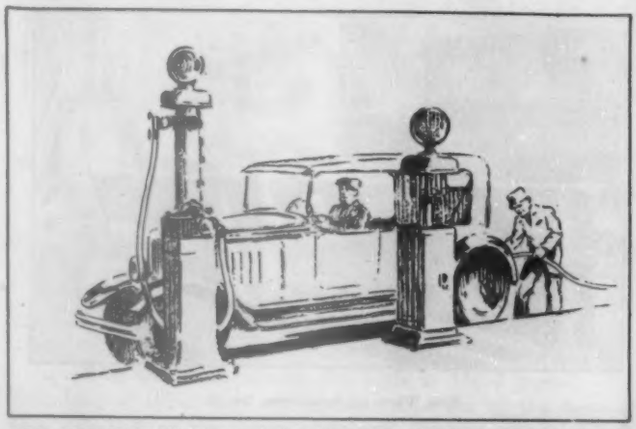
by the establishment of standards covering the principal classes of work done by oil drillers, refiners and distributors.

Good welding need not cost any more in the aggregate than poor welding, and often proves in practice to be really the least expensive so the setting up of scientific standards need not make welding cost more, no matter how much the quality of the work is improved. In many refineries work is being done by welding today that is classed with the impossible in other industries, and money is being saved by doing it.

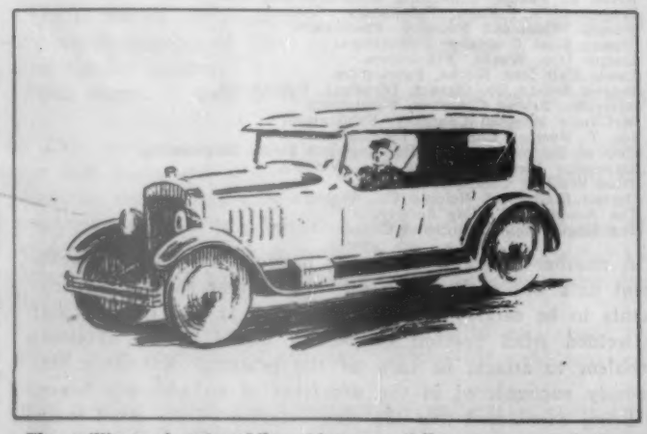
It would pay this huge industry which depends so much upon fusion welding to make a careful survey of tank and pipe welding and insist upon standards of workmanship which would realize the utmost economies. Designs of complete structures should be classified, for one thing, and the limitations of each class clearly defined. Then the designs of joints themselves, including details of preparation, reinforcement, testing, etc., come in for similar classification. Wherever welding technique or procedure have an influence on the quality of the finished work, from a service standpoint, recommendations in this directions are in order.

The human element need not be the variable factor that it has been in the past. It is so easy to distinguish a real welder from a "plasterer" that classification of operators would be the simplest part of any program of standardizing welding work. It is also the easiest way to raise the standard of workmanship in the industry.

Add to the studies mentioned, that of developing a rigid specification for testing, and provision for experimental work in further applications of the welding processes, and you have a fairly complete program of activity for a group of engineers in the oil industry to follow, with the expectation of generous dividends by way of reduced operating and maintenance costs.



The nearer gasoline approaches the consumer the more valuable it becomes; welded service station equipment is an aid to conservation, reducing the burden on the ultimate consumer.



The millions of automobiles using gas daily are many of them examples of high perfection of the welder's art. Welding puts them back in service, too, when they break down.

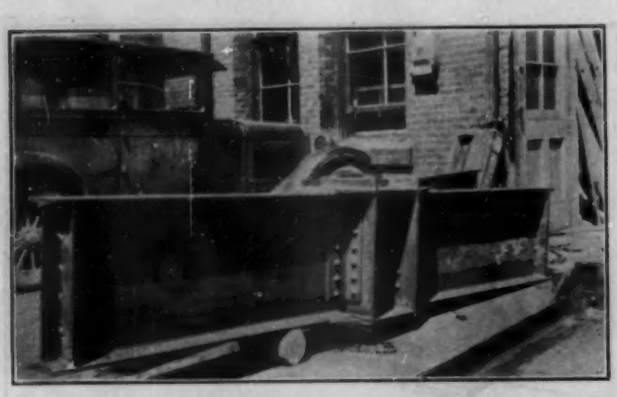
Arc-Welded Wind Bracing Connections

Tests to Determine the Capacity of a Given Conection Under High Bending Moments, and to Evolve the Requisite Data for Proper Design

By W. A. Hakin* and R. G. Richards**

ARC welding has been successfully employed during the course of construction of several large buildings in the City of Detroit, Michigan, as a means of connecting the steel framework of a new structure to that of an existing building. The store additions of the J. L. Hudson Company, the Crowley-Milner Company and the Peoples Outfitting Company may be cited as examples of this development of arc welding. The welding has been carried out by the Titus Welding Company and the Slaymaker Electric Welding Company of Detroit.

This use of welding aroused much interest concerning the potential value of welded structural members, and, under the guidance of Mr. Joseph Matte, Jr., of Detroit, who was primarily responsible for the adoption of the welded connection as an adjunct in the design, a committee was formed to investigate the possibility of the welded structural connection adapted to wider use.



End View of Specimen No. 8.

Membership of the Detroit Structural Welding Committee is as follows:

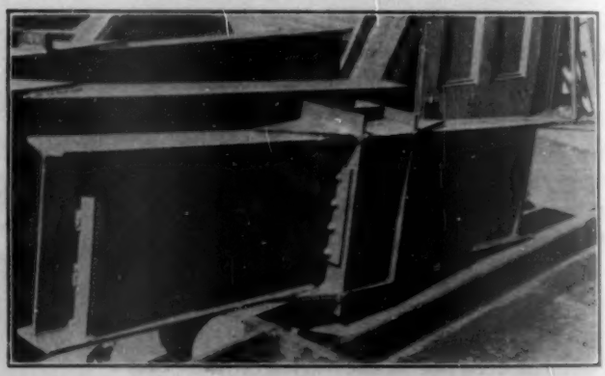
Albert Kahn, Inc., Architects.
Smith, Hinchman and Grylls, Architects.
Frank Nygren, Consulting Structural Engineer.
Arton E. Yokum, Consulting Structural Engineer.
Whitehead and Kales, Fabricators.
Russell Wheel and Foundry, Fabricators.
Mahon Steel Company, Fabricators.
Daigle Iron Works, Fabricators.
Lewis Hall Iron Works, Fabricators.
Detroit Edison Co. (Struct. Division), Fabricators.
American Bridge Company, Fabricators.
McClintic Marshall Company, Fabricators.
Jos. T. Ryerson Company, Fabricators.
City of Detroit, Dept. of Building and Safety Engineering.
Slaymaker Electric Welding Co., Welders.
Titus Welding Company, Welders.
Detroit Boiler and Welding Co., Welders.
The American Welding Society.
The Engineering Institute of Canada.

A number of preliminary tests having been prepared, sufficient data was gathered to enable a further series of experiments to be carried on a larger scale. It was decided that a welded wind bracing connection would be an excellent problem to attack, in view of the practical difficulties frequently encountered in the provision of an adequate brace, it being considered that the simplification of the wind brace connection would receive the approbation of designer and fabricator, and incidentally open a further field for the activities of the welder.

Designs were prepared and fabricated under the auspices of the committee and the specimens were subjected to test at the Perry Testing Laboratories, Detroit, Michigan, the object being to determine the capacity of a given connection under high bending moments, and to evolve the requisite data for proper design.

Analysis of Test Report Upon Welded Wind Bracing Connections

All tests were carried out upon double cantilever specimens, each specimen being composed of two I beams, symetrically attached to a short column section by means of standard type riveted web connections. Flat steel plates are placed upon the I beam flanges in close contact with the column face and thus welded into position. (Fig. 2.) The riveted connection is provided to carry the vertical shear, the flange stress being transferred from the I beam to the column section through the medium of the flange plate and the welded connection. It will be observed that the welds are not called upon to resist the vertical shear, their sole function being to act as end restraining mediums subject to induced tensile and horizontal shear forces only. The column is strengthened against local crippling by means of welded reinforcing plates, and the I beams are similarly stiffened along the web immediately above the points of support. (See Figs. 4b, 5b, 6b).



Specimen No. 16.

It is found desirable to utilize the full perimeter of the flange plate as a base for the weld metal where it comes into contact with the column face. A clearance of two inches is, therefore, provided between the end of the I beam and the column, in order that an adequate fillet of weld metal may be placed on the inside of the flange plate as readily as that obtaining on the outside. The angles forming the web connection are chosen for this reason with one leg somewhat longer than usually adopted on the standard shear connection, which is in other respects entirely normal.

The length of weld available at the column face is limited by the overall dimensions of the column. The length of

*Structural Engineer, Albert Kahn, Inc., Architects.
**Sales Manager, Slaymaker Electric Welding Company.

weld obtainable along the I beam is not ordinarily governed by limiting dimensions. Triangular plates were used in certain cases in order to utilize the maximum contact length afforded by the column face, and to conform with architectural limitations which may be imposed as to the width of flange plate and its overhanging effect beyond the flanges of the I beam.

The specimen is supported upon centers definitely located with respect to the column face, and the applied load is distributed over the head of the column such that the bending moment about the column face equals support reaction x lever arm.

Welds have been chosen of such dimensions as would appear to be practicable upon a commercial scale, and those welds which would in practice be carried out from the overhead position, have been effected in this manner throughout the entire range of specimens. The welding has been placed by three different establishments, and it has been observed that different operators have been employed from time to time in the execution of the welds. All welds were made by the electric arc process, the type of electrode and equipment and the strength of current used being that ordinarily employed by each individual establishment.

It was observed that in the majority of failures fracture occurred through the body of the weld itself rather than along a vertical or horizontal plane contiguous to the rolled steel surfaces, the angle of the critical plane being in the vicinity of 45 degrees, the exact angle of rupture being governed by the relative horizontal and vertical lengths of the fillet. (Fig. 1).

It will be appreciated that whilst the tension upon the weld section is definitely known in every case, it is necessary to determine the tensile area of the weld before the unit value of the bead may be computed. Two possible computations of area are apparent. The net area as derived from a measure of the fracture itself. The gross area derived from the condition of the weld before test. Gross area is here differentiated from Contact area. The net area from a measurement of the fractured weld would appear to be an excellent basis for the computation of the strength of an individual weld. Expert examination of fractured specimens afforded an agreement as to the portion of the weld which was effective, as clearly indicated by the crystalline structure of the broken metal. Inclusions of slag and oxide were deducted from the gross area, as were those portions of weld which showed smooth unbroken surfaces, indicating by the entire lack of fracture in these local areas and the smooth surface presented that penetration had not been obtained into the adjacent metal, and that the smooth spots had not contributed to the strength of the weld. Thus, net area = gross area — area ineffective.

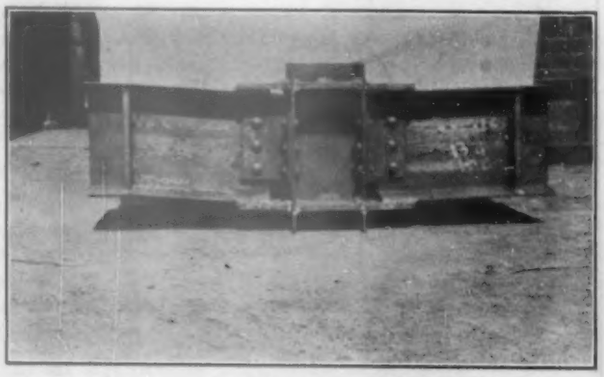
It is submitted that the above is not an ideal basis for design purposes, for the reason that it can never be known exactly how much weld is going to be effective and how much weld merely superficial. It is not sufficient to base the strength of welds in general upon the effective area of any one specimen. The next weld may, upon examination, be shown to have a greater net area; a further random specimen would doubtless be found deficient in this respect.

It is obvious, however, that there exists a limit to the net area of any weld, which cannot be greater than the gross area laid down. Whilst net areas, where available, are included in the tables as a matter of record and interest, together with the unit value of the weld based upon the net area, the true criterion of the weld strength is derived from a consideration of the gross area furnished by the welder.

The horizontal and vertical contact areas of the weld being subject respectively to tensile and shear forces of magnitude T, the area along the critical plane is subject to the normal and tangential components $\frac{T}{\sqrt{2}}$ of the axial force T. (Fig. 3.)

The unit weld strength as submitted in the accompanying tables is derived from the above shear along the critical plane, and equals $\frac{T}{a\sqrt{2}}$, the symbol "a" representing the area of the critical plane, which is derived from the apparent contact area A at the column face, as furnished by the welder.

Since $A = a\sqrt{2}$, the stress intensity may be written $\frac{T}{A}$, and it will be seen that the intensity of stress upon the weld section at the critical plane is equal to that obtaining upon the weld at the column face.



Specimen No. 26.

Values based upon the net area of fracture are derived from the measured area of fracture subject to force $\frac{T}{\sqrt{2}}$.

It will be appreciated that the welded connection involves the use of two distinct lines of weld.

(a) The welds connecting the plate to the column.

(b) The welds connecting the plate to the I beam.

Failure of either line will constitute failure of the connection. Failure of the flange plate will likewise comprise failure of the connection. The strength of the flange plate must not be overlooked; it is an essential element in the connection. It will be observed that failure by rupture of the flange plate has occurred in two instances during the present tests. (Table I.)

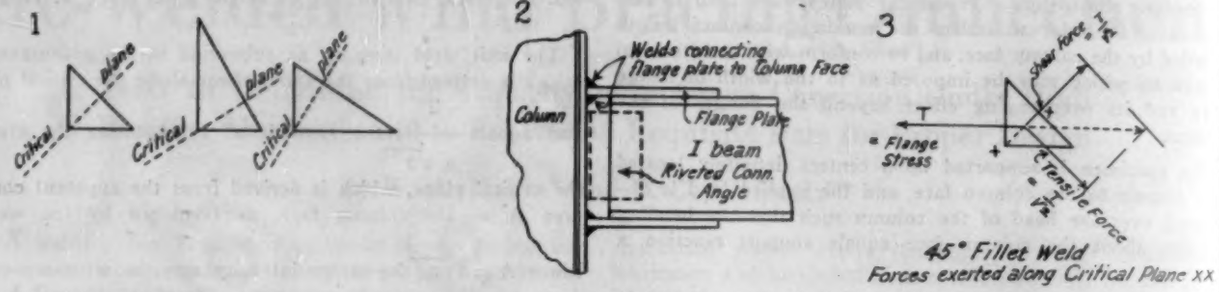
The total stress on all three elements is equal, and may be equated to $\frac{\text{Bending Moment (ft. lbs.)}}{\text{Depth of I beam (ft.)}}$.

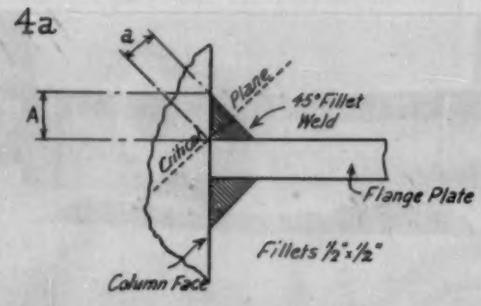
In so far as the respective welds are concerned, assuming the cross sections of fillets (a) and (b) to be of equal area and similar contour,

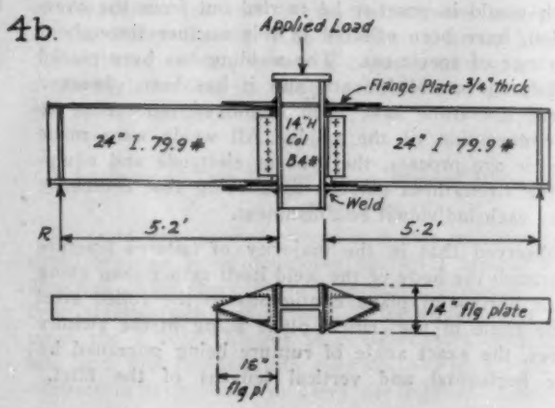
Total length of weld at column face = Total length of weld at I beam.

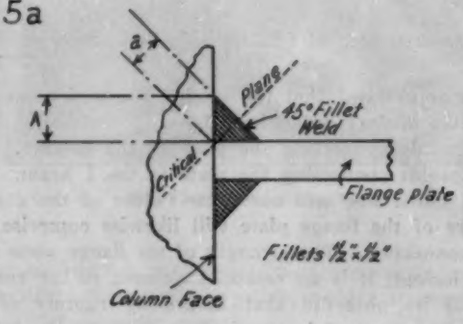
This condition will be realized when true 45 degree fillets are laid down and when the cross section of all welds are uniform throughout their length. It appears to be thoroughly practicable to produce welds having a high degree of uniformity, and any minor variation may be taken care of by assuring that the beads are made full rather than under developed.

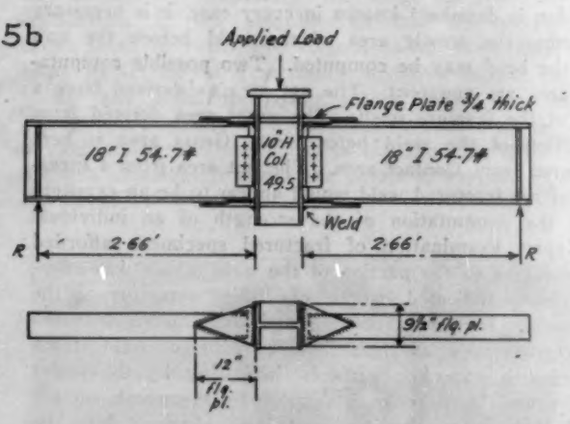
In the appended list, the contact area of each weld as given is an approximate quantity. Whilst the weld provided was sensibly $\frac{1''}{2} \times \frac{1''}{2}$ and commendably uniform in cross section, it was, nevertheless subject to an inevitable degree of

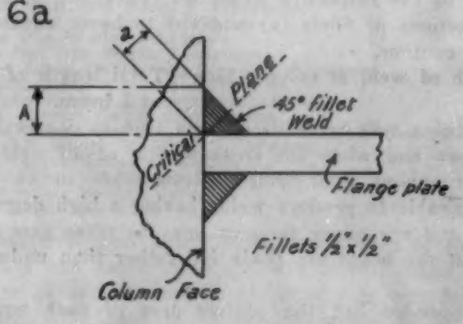

1
Critical plane
Critical plane
Critical plane
2
Welds connecting flange plate to Column Face
Column
Flange Plate
I beam
Riveted Conn. Angle
3
Shear force = T
T = Flange Stress
Transverse Force = T/2
45° Fillet Weld
Forces exerted along Critical Plane xx

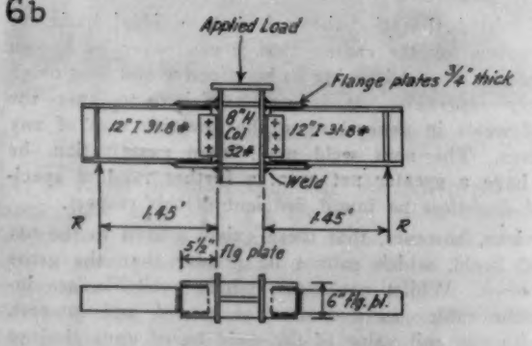

4a
a
A
Plane
45° Fillet Weld
Critical
Flange Plate
Fillets ½"x½"
Column Face


4b.
Applied Load
Flange Plate ¾" thick
24" I. 79.9#
14" H Col 84#
24" I 79.9#
Weld
R
5·2'
5·2'
14" flg plate
16" flg pl


5a
a
A
Plane
45° Fillet Weld
Critical
Flange plate
Fillets ½"x½"
Column Face


5b
Applied Load
Flange Plate ¾" thick
18" I 54.7#
10" H Col 49.5
18" I 54.7#
Weld
R
2·66'
2·66'
R
9½" flg. pl.
12" flg. pl.


6a
a
A
Plane
45° fillet Weld
Critical
Flange plate
Fillets ½"x½"
Column Face


6b
Applied Load
Flange plates ¾" thick
12" I 31.8#
8" H Col 32#
12" I 31.8#
Weld
R
1.45'
1.45'
R
5½" flg plate
6" flg. pl.

variation such that rendered any precise determination of its contact area impracticable. Furthermore, there existed an added area of weld adjacent to the thickness of the flange plate at the column face, and to take into account this small area 0.5 square inches has been added to the contact area afforded on the 24" I beam specimens, and 0.75 sq. in. to that apparent on the 18 in and 12 in specimens. The areas cited are composed as follows, and are believed to be sensibly accurate:—

Weld contact area for 24" I beams = (14"x0.5"x2) + 0.5 = 14.5 sq. in.

Weld contact area for 18" I beams = (9.5"x0.5"x2) + 0.75 = 10.25 sq. in.

Weld contact area for 12" I beams = (6"x0.5"x2) + 0.75 = 6.75 sq. in.

The weld length is derived from the width of flange plate adjacent to the column, as indicated in the sketches, and the multiple 2 in the above deduction takes care of two such areas, contact top and underside of flange plate respectively.

It has been stated in the foregoing remarks that different operators have been employed whilst the specimens were in the process of welding. The result in several cases was the inclusion of several welds of indifferent quality, a condition which was suspected prior to the testing of the specimens.

The opinion was advanced that these specimens should be excluded from test, but it was deemed, on the other hand, that to withhold these specimens would be equally unfair, as they had been executed, supposedly by a welder. It is, nevertheless, perfectly safe to state that under competent supervision, welds of this nature would not arise. Values for all welds are given, and where the measure of fracture is available, the quality of the weld may be judged by the ratio:

$$\frac{\text{Net area of fracture.}}{\text{Gross effective area of weld.}}$$

(Both areas taken along critical plane.)

This quantity is computed on the basis given above, and is expressed as "Percentage of effective weld area." It is left to the discretion of the reader to accept or reject any particular specimen on this basis. A comparison of the strength of the net section with that of the gross section, yields surprisingly high values credited to welds of poor quality, which is a primary reason for the adoption of the gross area rather than the net area as a basis of computation of unit strength.

The appended summary indicates the location of the weld failure where this has occurred, in certain cases the test has been terminated by the rupture of the flange plate itself, the weld remaining intact. In those cases where no failure of the connection, either in the plate or in the weld, has been recorded, the test was discontinued when it became evident that the ultimate load had been attained, as indicated by the drop of the beam of the testing machine.

Tables I, II, and III include the data upon which the computations are based, Table IV. being a summary indicative of the tensile strength per 1 in. run of half inch bead, together with unit values in terms of stress per square inch of contact area, the latter may be of general application irrespective of the size of bead employed.

Loads and stresses are ultimate in all cases. In Table IV the linear values and values per square inch are figured on the gross area of weld in contact with the work.

TABLE I

(Figs. 4a and 4b)

24" I Beams—79.9 lbs. capacity 435,000 Foot Pounds at fibre stress 30,000 lbs. per sq. in.

No.	Ultimate Applied Load	Support Reaction	Effective Lever Arm	Ultimate Bending Moment	Flange Stress	Deflection		Approx. Contact Area "A" at Col. Face	Net Area "a" of fracture	Percentage of Effective Weld Area	Unit Weld Strength		Remarks
						At Elastic Limit	At Ult. Load				on Gross Area	on Net Area	
	lb.	lb.	ft.	ft. lb.	lb.	in.	in.	sq. in.	sq. in.	%	lb. per sq. in.	lb. per sq. in.	
1	187,450	93,725	5.2	487,000	243,500	0.402	0.59	14.5	8.8	85.5	16,800	19,600	Weld failure at Col.
2	224,000	112,000	5.2	582,000	291.000	0.326	0.625	14.5	9.8	95.5	20,000	21,000	Weld failure at Col.
3	273,120	136,560	5.2	710,000	355.000	0.366	0.75	14.5	.....	.....	24,500	.....	No failure
4	259,900	129,950	5.2	675,000	337,500	0.329	0.68	14.5	.....	.....	23,250	.....	Fracture of flg plate
5	250,000	125,000	5.2	650,000	325,000	0.265	0.375	14.5	.....	.....	22,400	.....	No failure
6	273,900	136,950	5.2	712,000	356,000	0.399	0.84	14.5	.....	.....	24,500	.....	No failure
7	268,300	134,150	5.2	696,000	348,000	0.46	1.06	14.5	.....	.....	24,000	.....	Fracture of flg plate
8	122,000	61,000	5.2	318,000	159,000	.....	0.81	14.5	4.78	46.6	11,000	23,500	Weld failure at Col.
9	184.430	92,215	5.2	480,000	240,000	0.39	0.56	14.5	4.9	47.4	16,550	34,500	Weld failure at Col.

TABLE II

(Figs. 5a and 5b)

18" I Beams—54.7 lbs. capacity 221,000 Foot Pounds at fibre stress 30,000 lbs. per sq. in.

No.	Ultimate Applied Load	Support Reaction	Effective Lever Arm	Ultimate Bending Moment.	Flange Stress	Deflection		Approx Contact Area "A" at Col. Face	Net Area "a" of fracture	Percent. of Effective Weld Area.	Unit Weld Strength		Remarks
						At Elastic Limit	At Ult. Load				on Gross Area.	on Net Area	
	lb.	lb.	ft.	ft. lb.	lb.	in.	in.	Sq. in.	Sq. in.	%	lb. per. Sq. in.	lb. per sq. in.	
10	205.800	102,900	2.66	274,000	182,600	0.218	0.28	10.25	7.42	100	.....	17,800	Weld failure at Col.
11	247,400	123,700	2.66	328,000	219,000	0.172	0.42	10.25	.....	.....	21,350	.....	Weld failure at I beam
12	189,600	94,800	2.66	252,000	168.000	0.164	0.25	10.25	6.84	94.5	16,400	17,300	Weld failure at Col.
13	263,530	131,765	2.66	350,000	233.000	0.202	0.91	10.25	.....	.....	22,700	.....	No failure
14	233,400	116,700	2.66	310,000	214,000	0.155	0.375	10.25	6.47	89	20,850	23,500	Weld failure at Col.
15	265,000	132,500	2.66	352,000	235.000	0.302	1.03	10.25	.....	.....	22,900	.....	No failure
16	253.650	126,825	2.66	338,000	225,000	0.226	0.625	10.25	.....	.....	21,950	.....	Weld failure at Col.
17	235,830	117,915	2.66	314,000	209.000	0.172	0.375	10.25	.....	.....	20,350	.....	Weld failure at Col.
18	147,150	73,575	2.66	196,000	131,000	.....	0.188	10.25	.....	.....	12,800	.....	Weld failure at Col.

TABLE III
(Figs. 6a and 6b)
12" I Beams—31.8 lbs. capacity 90,000 Foot Pounds at fibre stress 30,000 lbs. per sq. in.

No.	Ultimate Applied Load	Support Reaction	Effective Lever Arm	Ultimate Bending Moment.	Flange Stress	Deflection		Approx. Contact Area "A" at Col. Face	Net Area "a" of fracture	Percent. of Effective Weld Area.	Unit Weld Strength		Remarks
						At Elastic Limit	At Ult. Load				on Gross Area.	on Net Area	
	lb.	lb.	ft.	ft. lb.	lb.	in.	in.	Sq. in.	Sq. in.	%	lb. per Sq. in.	lb. per sq. in.	
19	156,750	78,375	1.45	113,500	113,500	0.094	0.25	6.75	.....	.....	16,800	.....	Weld failure at Col.
20	163,830	81,915	1.45	119,000	119,000	0.078	0.19	6.75	4.41	92.5	17,650	19,100	Weld failure at Col.
21	181,450	90,725	1.45	132,000	132,000	0.063	0.23	6.75	.....	.....	19,500	.....	Weld failure at I Beam
22	186,600	93,300	1.45	135,000	135,000	0.063	0.25	6.75	.....	.....	20,000	.....	Weld failure at I Beam
23	196,100	98,050	1.45	142,000	142,000	0.125	0.5	6.75	.....	.....	21,000	.....	Weld failure at I Beam
24	146,000	73,000	1.45	106,000	106,000	0.140	0.31	6.75	.....	.....	15,700	.....	Weld failure at I Beam
25	202,000	101,000	1.45	146,000	146,000	0.125	0.56	6.75	4.12	86.5	21,600	25,000	Weld failure at Col.
26	207,860	103,930	1.45	151,000	151,000	0.078	0.69	6.75	4.84	100	.....	22,100	Weld failure at Col.
27	189,750	94,875	1.45	137,500	137,500	0.125	0.66	6.75	.....	.....	20,350	.....	Weld failure at I Beam

TABLE IV
Summary of Tests

24-In I-Beams					18-Inch I-Beams					12-Inch I-Beams				
Test No.	Approx. Length ½ in. Bead in.	Total Tension lbs.	Ultimate Strength per 1 in. Run of Weld lbs.	Ultimate Strength per sq. in. of Contact lbs.	Test No.	Approx. Length ½ in. Bead in.	Total Tension lbs.	Ultimate Strength per 1 in. Run of Weld lbs.	Ultimate Strength per sq. in. of Contact lbs.	Test No.	Approx. Length ½ in. Bead in.	Total Tension lbs.	Ultimate Strength per 1 in. Run of Weld lbs.	Ultimate Strength per sq. in. of Contact lbs.
1	29	243,500	8,400[1]	16,800[1]	10	20.5	182,600	8,900[1]	17,800[1]	19	13.5	113,500	8,400[1]	16,800[1]
2	29	291,000	10,000[1]	20,000[1]	11	20.5	219,000	11,675[1]	21,350[1]	20	13.5	119,000	8,810[1]	17,650[1]
3	29	355,000	12,250[1]	24,500[1]	12	20.5	168,000	8,200[1]	16,400[1]	21	13.5	132,000	9,750[1]	19,500[1]
4	29	337,500	11,625[2]	23,250[2]	13	20.5	233,000	11,350[2]	22,700[2]	22	13.5	135,000	10,000[2]	20,000[2]
5	29	325,000	11,200[2]	22,400[2]	14	20.5	214,000	10,425[2]	20,850[2]	23	13.5	142,000	10,500[2]	21,000[2]
6	29	356,000	12,250[2]	24,500[2]	15	20.5	235,000	11,450[2]	22,900[2]	24	13.5	106,600	7,850[2]	15,700[2]
7	29	348,000	12,000[2]	11,000[2]	17	20.5	225,000	10,975[2]	21,950[2]	25	13.5	146,000	10,800[2]	21,600[2]
8	29	159,000	5,500[2]	24,000[2]	16	20.5	209,000	10,175[2]	20,350[2]	26	13.5	151,000	11,200[2]	22,400[2]
9	29	240,000	8,275[2]	16,550[2]	18	20.5	131,000	6,400[2]	12,800[2]	27	13.5	137,500	10,175[2]	20,350[2]

Number in bracket thus:—([2]) denote shop producing the weld identified. Observe general consistency of strength of welds by individual establishments.

CHANGES IN A. W. S. PROGRAM

The following changes have been made in the program of the technical sessions of the Fall meeting of the American Welding Society, to be held at the Book-Cadillac Hotel, Detroit, September 19th to 23rd.

TUESDAY, Sept. 20th, Morning—Technical Session

1. Welding the Aircraft Structure by J. B. Johnson, Chief Material Branch, War Department, Air Crops, McCook Fied.

2. Welding in Aircraft Construction, Mr. Maylor, Chief Engineer, Stimson Aircraft Company.

3. The Bend Test as Applied to Welded Coupons by W. B. Miller, Union Carbide & Carbon Research Laboratories.

THURSDAY, Sept. 22nd, Morning—Technical Session

1. Study of Oxy-Acetylene Welding as Applied to Light Gauge Pressure Containers by H. J. Grow, Air Reduction Sales Company.

2. Welding in the Design of Steel Plate Work by L. J. Sforzini, Engineering and Maintenance Dept., Eastman Kodak Company.

THURSDAY, Sept. 22nd, Afternoon—Technical Session

1. Arc Welding in Buildings by Joseph Matte, Jr. of Albert Kahn, Inc.

2. A Recent Addition to the List of Arc Welded Buildings by G. H. Danforth, Contracting Engr., Fabricating Section, Jones & Laughlin Steel Corporation.

ARC WELDERS USED IN WILLYS-KNIGHT BODY ASSEMBLY

An article in Automotive Industries of April 16, 1927, points out the advantages gained by the utilization of electric arc welders on the Willys-Knight body assembly line, which constitutes a departure from the usual practice. Particular emphasis is placed on the advantages of arc welding on the formation of the joint between the cowl sheet and the stamped truss bar which is the foundation of the windshield frame. As usual, the cowl sheet is stamped from 20-gage steel while the truss bar is a 9-gage stamping which is approximately S-section and curves to form the contour of the cowl at the base of the windshield.

Water-Tight Joint

A water-tight joint is essential at this point and in the past both soldering and brazing have been tried. Both of these methods had pronounced disadvantages. Soldering produced a joint which temporarily was water-tight, of good appearance and easy to finish. However, the mechanical weakness of the soldered joint eliminated that possibility. Brazing and torch welding both had the disadvantage of applying too much heat to the cowl sheet and thereby caused warping and wavy appearance.

In the arc welding method, the relatively thin cowl sheet is fitted snugly to the truss bar and then five or six small deposits of metal are made to spot the joint. Following this a continuous bead of metal is deposited across the entire joint. The welding current is 50-60 amperes and soft flowing wire of 3/32 inch diameter is used for the deposit.

Several USL arc welders are mounted on platforms suspended from the ceiling. Long flexible welding leads extend from the welders and facilitate the work of the operators on the line. Controls which include a motor starter and field rheostat for each welder are located on adjacent posts within easy reach of the individual operators. Field rheostats are equipped with dials which are calibrated in amperes. Within the space of two adjacent graduations, the operator can control the current in steps of five to six amperes.

This method of attaching the cowl sheet has proved economical from the standpoint of both labor and material, and the quality of work turned out. Following the welding operation, the joint is finished off by a portable electric grinder and then polished preparatory to the paint shop operations.

Spot Welding of Dissimilar Metals

Uses of Spot Welding Process—Comparison With Other Methods—Electrode Material for Dissimilar Metals—Electrode Shape for Unlike Thicknesses

By R. T. Gillette*

SPOT welding of steel is very common practice among manufacturers of sheet metal articles, being used extensively in the automotive industry for welding bodies, door and window frames, radiator shells and brackets, fans, mufflers, splash pans, and other parts made from sheet metal. It is also used by the makers of steel office furniture and household equipment in the form of desks, chairs, kitchen cabinets, stoves, ovens, or cooking utensils, and in the manufacture of toys, lockers, and a great variety of small tools and devices.

A saving is usually effected in cases where it is possible to apply spot welding in lieu of riveting or other forms of welding. Where it takes the place of riveting, the economy appears in eliminating the cost of the rivets themselves and in time

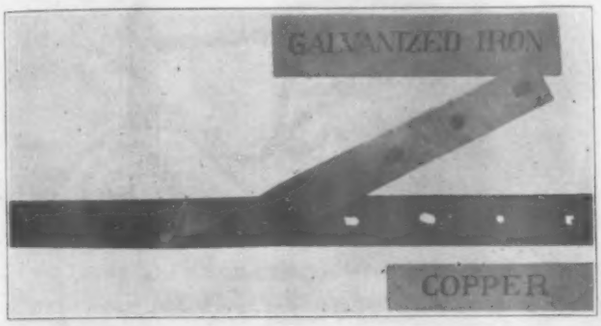


Fig. 1—A Spot Welded Sample of Dissimilar Metals Torn Apart to Indicate Strength.

saved in the process. Spot welding is much faster than riveting, since there is a total absence of the drilling and aligning of holes and the upsetting of the rivets; and spot welding on parts that are easily handled may be accomplished at the rate of seventy-five to one hundred and fifty welds per minute.

An additional advantage of spot welding lies in the fact that it produces a strong, rigid joint which has three distinct characteristics; there is no movement between parts, which sometimes occurs in riveted parts when the rivets work loose from vibration; there is no buckling, which is often produced in

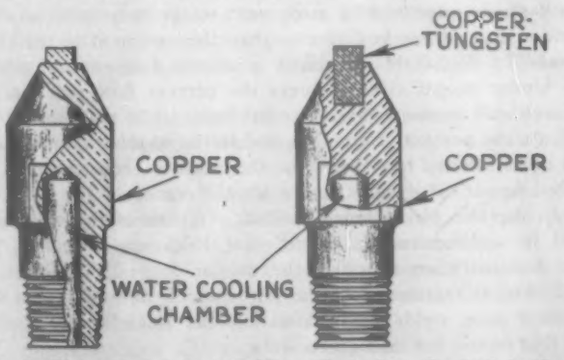


Fig. 2—Water Cooled Spot Welding Electrodes. On Left is Shown One of Solid Copper; and on Right Is a Copper Electrode with an Insert of Copper-Tungsten Alloy.

forcing an alignment of rivet holes in assembly; and the surface is left free of projecting rivets or the seams of the other forms of welding, ready to take the paint or other finish.

Manager's Staff, Schenectady Works, General Electric Co.

Moreover, when relatively thin metal is used, three or four thicknesses of material may be spot welded together.

What has heretofore been written about spot welding is concerned mainly with the spot welding of steel. It is the purpose of the present article to give the writer's observations regarding the spot welding of certain ferrous and non-ferrous metals and alloys which may be readily welded by the proper selection of welding machine, electrodes, and values of time, current, and pressure.

Aluminum and brass are easily welded by using two electrodes of the proper percentage compositions of Elkonite (copper-tungsten alloy), one being chosen with a comparatively high percentage of tungsten, together with the correct combination of welding current, time, and pressure. On the other hand, copper, one of the most difficult metals to spot weld, may be welded by using two electrodes of pure tungsten with relatively high current and pressure.

Combinations of metals (Fig. 1) dissimilar in heat and electrical conductivity are best welded by the use of two dissimilar electrodes such as one of copper and one of copper-tungsten alloy of high tungsten content. In general, the pair of electrodes best suited to particular combinations of metals may be determined by studying the heat conductivity and electrical resistance of the metals and selecting electrodes to give a bal-

METALS	ALUMINUM	ASCOLOY	BRASS	COPPER	GALVANIZED IRON	IRON	LEAD	MONEL	NICKEL	NICHROME	TIN PLATE	ZINC
ALUMINUM	•											
ASCOLOY		•		•	•	•		•	•	•	•	
BRASS			•	•	•	•		•	•	•	•	
COPPER		•	•	•	•	•		•	•	•	•	
GALVANIZED IRON		•	•	•	•	•		•	•	•	•	
IRON		•	•	•	•	•		•	•	•	•	
LEAD							•					
MONEL		•	•	•	•	•		•	•	•	•	
NICKEL		•	•	•	•	•		•	•	•	•	
NICHROME		•	•	•	•	•		•	•	•	•	
TIN PLATE		•	•	•	•	•		•	•	•	•	
ZINC												•

Fig. 3—Combinations of Metals Which Have Been Successfully Welded.

anced heating effect in bringing the parts to the welding temperature with no tendency to overheat one of them.

For example, combinations like copper with galvanized iron or copper with nichrome (metals of widely different electrical and heat conductivity) may be welded by using a copper electrode next to the nichrome and an electrode of an alloy rich in tungsten content next to the copper. This will give a balanced heating effect, the low-resistance copper electrode in contact with the high-resistance nichrome helping to conduct away the excessive heat caused by the high resistance of the nichrome, while the heat in the low-resistance copper of the part being welded is intensified and localized by its contact with the relatively high-resistance copper-tungsten electrode. This causes

the two dissimilar metals to heat evenly to the welding temperature. When two like metals are to be welded, both electrodes are the same. Metals of high conductivity are welded by the use of electrodes of high resistance, and metals of low conductivity by the use of electrodes of low resistance.

A wide choice of electrode material is available, ranging

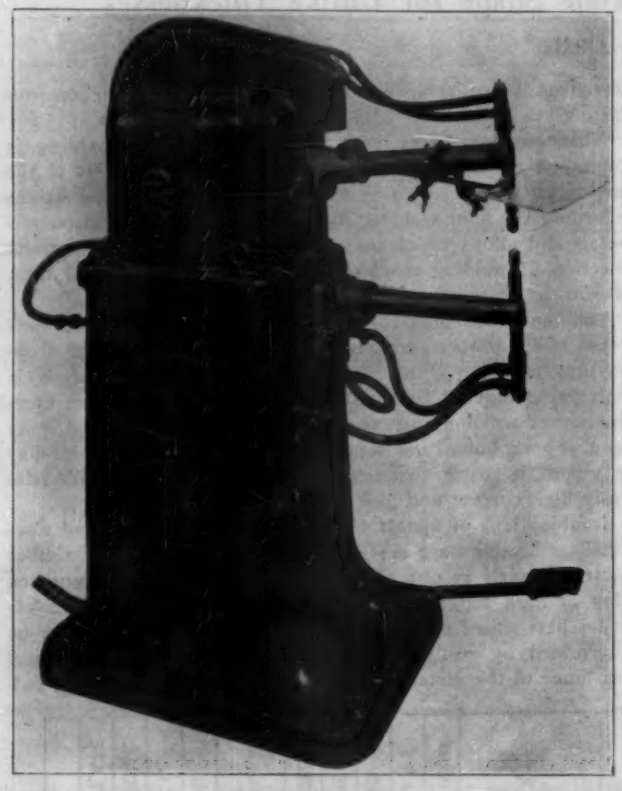


Fig. 4—Spot Welders Used in Making the Test Welds.

from pure copper of high conductivity through the copper-tungsten alloy series (in which high copper, low tungsten content gives low resistance; and low copper, high tungsten content gives high resistance) to pure tungsten which has a still higher resistance. Pure tungsten is seldom used except in

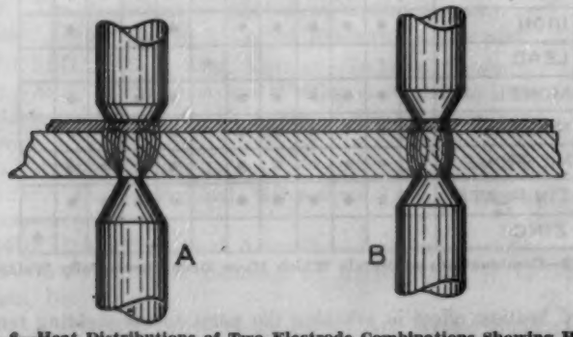


Fig. 6—Heat Distributions of Two Electrode Combinations Showing How and Why Electrode Shape Should Be Adjusted to Metal Thickness.

cases where two pieces of metal of very high heat conductivity are to be welded.

Where the copper-tungsten alloy or pure tungsten is employed, it is best to use inserts as shown in Fig. 2 instead of making the entire electrode of the alloy or of tungsten, which, besides making cost of the electrode excessive, introduces too much high-resistance metal into the welding circuit, thus giving rise to unnecessary heating of the machine.

The chart given in Fig. 3 shows different combinations of metals which have been successfully welded.

The machine in Fig. 4 shows the type of spot welder used for these welding tests. A close-up view of the work and electrodes, which have cooling-water brought very close to the end, is shown in Fig. 5.

The metal requires no special preparation for spot welding; the seams are made by the lap method. The main requirement for a satisfactory weld is that the metal must be clean and free from sand, dirt, oil, scale or oxide which would prevent metal-to-metal contact. The oxides of most metals are of very high resistance; and, when high enough voltage is used to

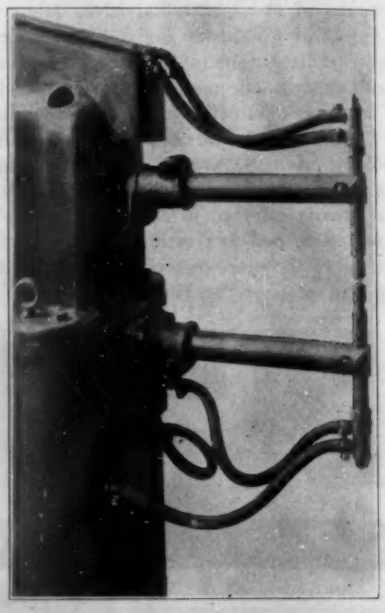


Fig. 5—Electrodes and Cooling System of Spot Welder Shown in Fig. 4, Making a Sample Weld.

break down the scale, there usually results such a rush of current when the scale breaks down that the metal being welded quickly overheats, causing it to melt and form blow holes through the material before the current can be shut off. When the scale does not cause blowing, the welds have scale inclusions which make a weak, brittle weld.

Material that is oily and dirty should be washed in some good metal cleaner; and heavy scale may be sand-blasted or ground from the area within which the welds are to be made.

Metal of different thicknesses may be welded, for example, a 1/16-in. to a ¼-in. strip or plate. The heat conditions in this case are improved by using next to the thin metal an electrode a little larger in diameter than the one next to the thick metal. In Fig. 6 this condition is shown diagrammatically at A. Under proper circumstances the current flow will fan out on each side as shown by the radial lines, while the dotted lines indicate the portion of metal heated to the welding temperature, the most intense heat being in the narrow area between the dotted lines. This constriction should center in the joint between the two pieces being welded. If both of the electrodes used in welding metals of different thickness are alike, the heat concentration is within the thicker one of the pieces, as in B, Fig. 6, instead of in the joint, which in some cases will produce poor welds by overheating the thick section before the thin one is hot enough to weld.

Usually, like metals, and combinations of dissimilar metals which are successfully spot welded, may also be line welded by the use of the same combination of welding wheels as is used for spot welding electrodes on the same metal. In line welding it is usually desirable to use an interrupter in the primary circuit of the welding machine which gives, in effect, a series of overlapping spot welds. This makes possible the use of a much higher welding current without danger of burn-

ing through the metals being welded if a thin spot or other imperfection should be encountered.

In making the welding tests, material from 1/32 to ¼-in. thick was cut into strips one inch wide. The welds were made in a row along the center line of the strip. This is shown on the sample strip in Fig. 1. Tests were made by pulling the strips apart. If the pieces pulled apart without making a hole in either, it was considered as no weld; but when the welds pulled a hole through either strip, the weld was considered as strong as the weaker material, and therefore successful.—*From General Electric Review.*

NEW GE WELDING ELECTRODE DISTRIBUTORS APPOINTED

Announcement has been made by the Merchandise Department of the General Electric Company, Bridgeport, Conn., of the appointment of 27 new distributors for their Welding Electrodes. Each of these new houses, which are handling the line as of September 1, will carry adequate stock of the three types of GE Welding Electrodes, Types "A", "B", and "F". The new distributors are as follows:

Home Electric Company, Tacoma, Washington.
Mid-West G. E. Supply Co., Kansas City, Missouri.
Mid-West G.E. Supply Co., Omaha, Nebraska.
Mid-West G. E. Supply Co., Des Moines, Iowa.
James Clark Jr. Co., Louisville, Kentucky.
G. Q. Electric Company, Milwaukee, Wisconsin.
Lake States G. E. Supply Co., Columbus, Ohio.
Lake States G. E. Supply Co., Dayton, Ohio.
Lake States G. E. SupplyCo., Toledo, Ohio.
Lake States G. E. Supply Co., Cleveland, Ohio
Lake States G.E. Supply Co., Cincinnati, Ohio.
Lake States G. E. Supply Co., Indianapolis, Indiana.
Lake States G. E. Supply Co., Evansville, Indiana.
Butte Electric Supply Co., Butte, Montana.
Protective Elec. Sup. Co., Fort Wayne, Indiana.
Northwest G. E. Supply Co., St. Paul, Minnesota.
Northwest G. E. Supply Co., Minneapolis, Minnesota.
Central Sta. G. E. Supply Co., Chicago, Illinois.
Halpin & Kollby, St. Loius, Missouri.
Crescent Elec. Sup. Co., Dubuque, Iowa.
Crescent Elec. Sup. Co., Davenport, Iowa.
Crescent Elec. Sup. Co., Madison, Wisconsin.
South Bend Elec. Co., South Bend, Indiana.
Sutton Electric Co., Wichita, Kansas.
Swords Electric Co., Rockford, Illinois.
Northwest Elec. Eq. Co., Duluth, Minnesota.
Michigan Welding Electrode & Equipment Co., Coe Terminal, Detroit, Michigan.

The following companies have been distributors for GE Welding Electrodes for some time and will continue to be:

American Steel Engineering Company, Philadelphia, Pennsylvania.
American Steel Engineering Company, Pittsburgh, Pennsylvania.
Bird-Potts Company, Atlanta, Georgia.
Capital Electric Company, Salt Lake City, Utah.
Robert M. Hartwell Company, Los Angeles, California.
Hendrie & Bolthoff Mfg. & Sup. Co., Denver, Colorado.
P. F. McDonald & Co., Boston, 27. Massachusetts.
Matthews Electric Supply Co., Birmingham, Alabama.
National Welding Equip. Co., San Francisco, California.
Root, Neal & Co., Buffalo, New York.
Seattle Hardware Company, Seattle, Washington.
Southern Electric Company, Baltimore, Maryland.
Southern Electric Company, Charlotte, North Carolina.
Southern Electric Company, Norfolk, Va.
Southern Electric Company, Richmond, Virginia.
Southwest G. E. Supply Co., Dallas, Texas.
Southwest G. E. Supply Co., Houston, Texas.
Southwest G. E. Supply Co., Oklahoma City, Oklahoma.
Strong, Carlisle & Hammond Co., Cleveland, Ohio.
Virginian Electric Inc., Charleston, West Virginia.
A. J. Wilson Co., Inc., New York City, New York.
W. A. Ramsay, Ltd., Honolulu, Hawaii.
Oliver H. Van Horn Co., Inc., New Orleans, Louisiana.
Welding Service Company, New York City, New York.

WELDS CAST IRON CRANKCASE WITH HYDROGEN

It may be all right to say "Yes" to our welding brothers most of the time when possibilities and impossibilities come forward for discussion, but when something different comes our way every day in the pair line of welding and to skepticals, I would say "No" under any circumstances. The question is always "Can it be done?" and the answer is always the same, "Oh, yes."

Farmer Sabrisky had an International tractor that showed its unappreciation by developing a broken piston rod and letting the stump knock pieces out of the crankcase and crankcase pan. The pieces were lost and the question came, "Can it be done?"

Looking it over, we said, "Yes," and then proceeded to fix it. To replace the broken pieces, we used ¼" sheetsteel and fitted them to the openings. Then we used cast iron welding rod and ordinary flux and then welded the sheetsteel pieces in place. As it is always interesting to try something different and as we happened to have a cylinder of hydrogen we used that instead of acetylene. We used our acetylene apparatus except the regulator. It worked beautifully but perhaps not so fast as acetylene but fast enough to make an economical welding. After testing it, we decided to take a couple of photos of it for memory's sake, and here you can see, yourself. The tractor has been in use now for more than two years after repair and is still going almost every day, so the job turned out good. There is a very pleased farmer, because he told me he saved about $67.00, not having to buy new parts.

This Oxy-Hydrogen Weld Saved $67.00 for the Customer.

Oh, yes! We made $14.00, the cost to us being about $6.00.

Fransson, the Welder.

NEW SAFES PROOF AGAINST TORCH

Typical contrivances for safes and strong rooms are described in a recent issue of the trade and engineering supplement of *The London Times*. The patent anti-blowpipe devices ensure perfect security even if the lock is cut out or destroyed by explosives. These patent devices operate by the melting of one of the fusible links in the mechanism in the case of any serious attempt with the blowpipe. The severing of these or other links in the mechanism brings into action a series of automatic hinged bolts. These bolts are themselves securely locked in position, and thus practically the whole door must be destroyed before entry can be gained. One company manufacturing anti-blowpipe safes back drill-proof plates with a special oxy-acetylene resisting material inserted in a peculiar fashion.

Horizontal Welds on Vertical Plates

Comments on Tests That Have Been Made to Determine the Best Preparation of Parts and Best Welding Technique

By D. Richardson in The Welding Journal

IN all oxy-acetylene welding operations the welder must be expert in depositing the metal for the particular job in hand. In practice we find that welders who, on certain classes of work, can make perfectly sound welds will, on being confronted with a different type of welding operation, find that they are quite unfitted for the task. For example, a welder that can make excellent flat welds might not be able to make welds in other positions such as vertical, horizontal, overhead, etc., or to weld steel of a distinctly different thickness to which he has been accustomed, even on the flat. Hence any practical advice which may be of some service to a welder who desires to overcome the difficulties of what might be termed the special problems of welding manipulation, should prove profitable. Such information is to be found in an article in the current

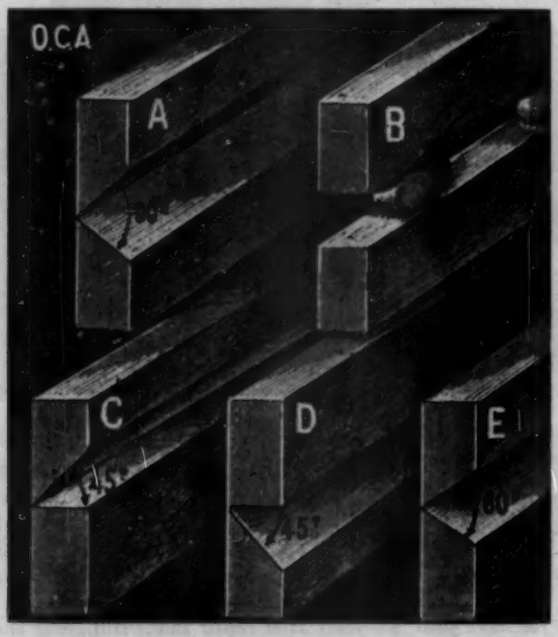


Fig. 1.

issue of the *Revue de la Soudure Autogene*, in which the author, R. Meslier, deals with the making of horizontal welds and of which the following is a translation:

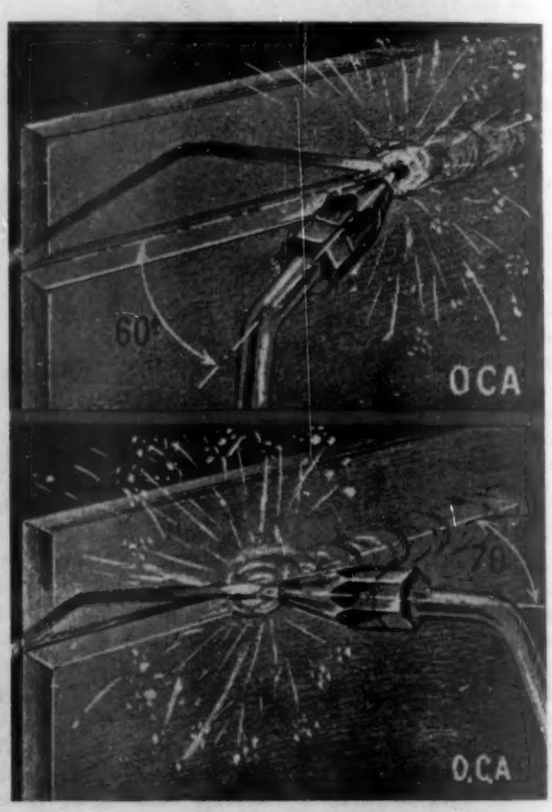
Amongst the various positions of welds that come within the range of an oxy-accetylene welder that known as "horizontal" or "side seam" is without doubt the least favorable for obtaining good penetration and of uniform cross section, and such welds, for the average welder, present formidable difficulties.

In fact, when the two edges of the plates are raised to the melting point, the metal from the upper edge flows under the action of gravity and tends to solidify on the lower edge, and it seems that all movements given to the blowpipe are powerless to make good the channel thus formed; under any circumstances the time factor for making the joint is considerably increased. Again, even when a gap is left between the edges to be welded, it will be invariably found that the penetration is insufficient.

In ordinary welding practice it is often necessary to make horizontal welds on vertical plates as for example in the repair of boilers, ship construction, and the building of large containers where it would be difficult to bring the welding seams into a flat position.

With a view to determining the best conditions for facilitating the execution of horizontal welds, a series of tests have been made with the dual object of finding the best preparation for the edges and the best manipulative methods.

Taking as a starting point, the ordinary or "continuous" method of welding, that is from right to left, and applying it to steel sheets about 1/8 in. thick, with the various preparations shown in Fig. 1, we have ascertained that the method of prep-



Figs. 2 and 3.

aration has little influence on the facility of execution. Perfect blowpipe control is necessary in all cases to avoid the formation of the undesirable channel at the upper part of the weld.

The "backward" method of welding, that is from right to left, was applied to a similar series of prepared sheets and gave corresponding results, the only difference being that, in a general way, there is an increase in the speed of welding and better penetration. There was the same great difficulty in avoiding the sagging of the weld metal, and consequent channelling at the top of the welded seam.

As a result of the tests it was determined that the operating method which has been used by certain welders over a long period for the welding of thick plates in a flat position, is the best. This method of welding by successive overlapping molten puddles, known as the "localized puddle" has been described in the articles on "Practical Oxy-Acetylene Welding." When used for making horizontal welds on plates placed in a

vertical position the welder can obtain a free and normal melting of the edges, perfect fusion with the welding wire, control of the degree of penetration and uniformity and smoothness at the surface. This method is the nearest approach to backward welding.

The preparation which has been found to give the most satisfactory results is that shown at E, Fig. 1, because it is favorable to good welding speed and economy in operation.

As in welding in the flat position, a horizontal weld made by the localized puddle method consists of obtaining successive overlapping pools of molten metal well bonded together. It is not necessary for the welder to trouble about the surface in fusion, which is strictly limited and of small dimensions, but he must concentrate on manipulating the blowpipe skilfully in order to prevent the flow and sagging of the weld metal and at the same time instinctively give the correct manipulation to the welding wire. The weld is commenced by a forming of an elongated oval puddle of metal about 5/8 in. wide and 7/8 in. long, the dimensions of which should not be exceeded. Care should be taken to melt the metal throughout its thickness and see that it tends to flow in that direction. The gap is filled up and the puddles smoothed off by means of the flame.

The next overlapping puddle, immediately to the left of the first, is then made. Continuity at the base of the weld and the risk of adhesion at the junction of successive pools can be dealt with by inclining the flame at the commencement in a direction towards the first pool, as shown in Fig. 2. The angle between the surface of the plate and the direction of the flame being about 60 degrees. In this manner a small portion of the previous solidified puddle is remelted after which, the blowpipe is returned and manipulated in its normal position, and the second puddle completed in the manner described for the first. Throughout the welding operations the flame is pointed upwards, at about 70 degrees, Fig. 3, but not excessively, because it is not so much the force exerted by the flame that prevents the sagging of the metal, but the surface tension of the molten metal in conjunction with the presence of the welding wire, which, by the way, is retained in the molten puddle until the particular pool is complete.

The blowpipe should be of a slightly less power than that used for welding the same thickness of material in a flat position, for example, 30 cubic feet of acetylene per hour instead of 35 when welding 3/8 in. plates.

The above is practically all the technical information that can be given for obtaining welds in a position where so much depends upon the instinctive and skilled movements made by the operator at the required moment. The remarkable uniform results obtained by expert oxy-acetylene welders without apparently any definite scheme of blowpipe manipulation would, on analysis, be found to be due to their adopting a definite procedure for any particular job. In many cases welders possess a remarkable intuition which enables them to size up the work and adapt their methods to its successful realization. On the other hand, the average welder should, as a result of following the advice given in this article, rapidly acquire results which are only obtained by the expert welder, who, as a result of his skill in obtaining satisfactory horizontal or vertical welds on vertical plates, is looked upon as being in a class by himself, in the majority of workshops.

FLUXES—THEIR USE IN WELDING

By Paul Ross

(Note: The author is a student in the Welding Department of the Denver Opportunity School, and the essay is a mid-term paper prepared for school credits. It is this study of fundamental things in welding which makes students of this school popular with employers. These fundamental principles are not secrets; they are all available in book form, ready for the attention of welders, foremen and supervisors who want to see welding done as it should be.—Editor.)

The need for fluxes in welding varies with the metals to be joined and the fluxes themselves may be classified undr two general headings—Cleansing fluxes and protective fluxes.

In the welding of mild steel by the oxyacetylene process no flux is needed, as all of the oxides formed by this material are lighter than the metal itself and are easily floated on the molten pool. The oxides of mild steel melt at a lower temperature than that required to melt the steel and are therefore easily handled if proper care is taken in the welding operation. Th envelope flame of the blow-pipe can be made to protect the weld from atmospheric influence until the metal has solidified, and, therefore, all need for fluxing has been eliminated.

The arc welding of even mild steel presents a more complicated problem, due to the absence of an envelope flame or other reducing atmosphere. Under these conditions there is great probability that oxides will be entrapped and in many cases the surface of the highly heated metal is attacked by the oxygen of the air before it has cooled sufficiently to prevent the absorption of gases. The most successful method of overcoming this condition is found in a flux coating on the electrode which combines with the oxides of iron to form a slag which spreads over the surface of the weld and excludes atmospheric gases. On cooling, this slag crystalizes into a hard glassy substance which is easily removed with a hammer and leaves a clean metallic surface for the next layer of deposited metal.

Quite a few of the alloy steels are better welded by using a cleansing flux to dissolve the complex oxides which are formed by the alloying element. Most of the alloys form what are called "infusible oxides," which only means that they are not fused at a temperature permissible in welding. Where these alloy steels are welded with the blow-pipe, a protective flux or slag is seldom needed for reasons previously set forth, but if the arc is used a slag forming flux is indicated, especially if the alloying element has a great affinity for oxygen.

In the welding of high-carbon steels the use of a flux is of value for the same reason that makes its use imperative in cast iron welding. The presence of comparatively large quantities of carbon in molten or highly heated iron causes the oxides to be more or less complex and infusible, depending on the amount and condition of the carbon present. The oxides formed in welding cast iron melt well above 3,000° F. It is possible to "puddle" cast iron and weld without a flux, but it is a very slow and laborious process and the results are uncertain, therefore, the use of a good flux in small quantities is recommended where cast iron is to be welded. The cast iron fluxes are of a dual nature and serve as both cleansing and protective agents. The slag which floats on the molten pool should be left undisturbed as much as possible and should not be removed until the metal is below the point where rapid oxidation occurs. The practice of skimming the weld metal is to be condemned. The weld should be built up high enough to permit this slag being ground off after the weld has cooled in order that a full weld of good clean metal will result.

The welding of the non-ferrous metals presents a different set of problems, as quite a few of these form infusible oxides, while the metals melt at a comparatively low temperature. Copper is the most prominent exception to the general rule of fluxing. If a flux is developed which does not affect the metal nor enter into the weld, copper welding will be helped thereby. Borax is quite often used on copper and this gives a protective coating which is quite satisfactory, but is detrimental to the weld, due to the formation of copper borates, which are insoluble and remain in the weld, tending to make it brittle.

Puddling is the only method of welding aluminum without a good flux. Puddling is very slow and is not recommended for any but cast pieces. The fluxing of aluminum is of such importance to industry that one manufacturer has patented, not only a formula, but also a process for using an aluminum flux. By the use of his process he claims a saving of from 40 to 60 per cent in welding costs.

TESTS BY BUREAU OF MINES SHOW WELDED JOINTS GIVE MINIMUM LEAKAGE

A recent report issued by the Bureau of Mines, shows important advantages for welded natural gas pipe lines over the screw-coupled and rubber-coupled joint types.

"The tests that have been run on welded lines show conclusively that this type of construction is preferable, as far as leakage is concerned," says the Circular, No. 6010, by E. L. Rawlins.

Welding a Joint in a 16-inch Pipe.

To arrive at this conclusion, 26 lines were studied. Of these, there were 11 screw-coupled lines, 9 rubber-coupled lines, and 5 welded lines. Operating pressures in these lines varied from 165 to 300 lb. per sq. in. The lines were located in all parts of

Testing Set-up for Welded Natural Gas Line.

the country and varied widely in age of pipe, local conditions, terrain and temperature. The figures are given below:

LOSSES IN CU. FT. PER YEAR PER MILE, 3 IN. LINE AT 100 LB. GAUGE
(USING EQUIVALENT MEASUREMENTS)

SCREW-COUPLED LINES			RUBBER COUPLED LINES			WELDED JOINT LINES		
Line No.	Loss	Oper. Pres.	Line No.	Loss	Oper. Pres.	Line No.	Loss	Oper. Pres.
1	4,916,000	165	12	7,450,000	260	21	625,000	165
2	4,299,000	165	13	825,000	260	22	68,000	290
3	2,581,000	165	14	1,400,000	260	23	17,000	165
4	15,100,000	160	15	961,000	260	24	512,000	290
5	1,625,000	120	16	800,000	270	25	75,000	280
6	686,000	230	17	400,000	140	26	630,000	300
7	660,000	170	18	3,400,000	210			
8	1,142,000	140	19	912,000	230	Total	1,917,000	1,470
9	1,091,000	140	20	66,000	210	Avg.	319,000	248
10	1,037,000	230						
11	1,443,000	225	Tot'l	16,414,000	2,100			
			Avg.	1,823,000	233			
Tot'l	34,580,000	1,920						
Avg.	3,143,000	174						

From the above figures, which are for 26 different lines and not comparable other than by average, it will be seen that the loss of the screwed line is about ten times that of the welded line, and the rubber-coupled line is about six times as great.

Much of the loss in a welded line is due to connections at valves and attached apparatus. In constructing high pressure lines for petroleum transportation, it is possible to make pipe lines in which no leakage is measurable. Even in natural gas lines, welded joints will show no leakage, if properly made and tested in the first place. Still the gross loss, as indicated by the report is so far below other types of joints as to be notable.

The report points out that no "standard" leakage rate can be given, each line having a characteristic leakage due to type of joint, location, diameter of pipe and pressure.

The data given are a conclusive source of facts arguing for welded joints for leak-proof construction of pipe lines.

FINDS NEW USE FOR OXYGEN LANCE

By U. V. Westover, Welding Specialist, Wickwire Spencer Steel Co.

A malleable iron company found it advisable to eliminate as much space as possible between the bungs and fire box of the melting furnaces in order to conserve coal and concentrate the heat as close as possible to the charge of iron to be melted.

The thing could be done at a small cost, providing the cast iron walls of the fire boxes, which have been in constant use for ten to twenty-five years, could be lowered. The walls were one to two inches thick, five feet high, with a total running length of twelve feet.

It was necessary to lower the height of the fire box nine to ten inches to correspond with the height of the melting floor.

Now, anyone closely acquainted with electric and acetylene welding must surely realize the difficulty encountered when cutting cast iron in this case.

After trying the cutting torch, they found that it was very slow work combined with the disagreeable action of the iron, made doubly so by the background of fire brick lining of the fire box, leaving no space for the metal to work out except back toward the torch into the face of the operator.

After doing a little thinking, they tried the Oxygen Lance in conjunction with the Davis Bournonville welding torch, using a No. 10 Tip. The Oxygen Lance is a ten-foot, quarter inch iron pipe, connected to a tank of oxygen with a length of hose.

After getting the metal molten with the torch at the place where the cut was desired, the lance was applied with fifteen to twenty pounds pressure and was found to give the desired result, maintaining, at the same time, a very uniform line. During the operation it was necessary to melt the iron with the torch occasionally, in order that the action of the lance might not be lost. This was done, working no great hardship upon the operator handling the torch.

There were ten of these furnaces and the time for two operators was three hours, consuming sixty cubic feet of acetylene and six hundred cubic feet of Airco oxygen per furnace, at a cost of $11.90 per furnace, including operators' time and material, or about $1.00 per foot for cutting.

To some of the readers this may seem an exorbitant cost, but after considering all other possible procedures to get the desired results, the plant owners were convinced that the name "Wonder Worker" when applied to oxygen is very appropriate.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION TO MEET AT PINEHURST, N. C.

The fifth annual convention of the American Institute of Steel Construction will be held October 25-29, at Pinehurst, N. C. Further details regarding the convention may be secured from Charles F. Abbott, executive director, 285 Madison Ave., New York, N. Y.

An Arc Welded Residence

A Steel Framed Building With All Joints Welded, Which Offers Many Advantages Over Other Types of Building Construction

By J. G. Dudley

WHAT is, so far as known, the first electrically welded house has been built at Teaneck, New Jersey, as a residence for George B. Hitchcock, realtor of that town. It is approximately 65 ft. long by 25 ft. depth, with approximately 40,000 cu. ft. contents. Architecture and framing construction are shown in the accompanying illustrations.

A Completed Residence of the "Weldcrete" Type Welded Lathing.

"Weldcrete" is the designation of this house, derived from "welding" and "concrete."

As will be noted, the framing follows almost identically the procedure used in building wood-framed houses—except that each stud, sill, plate, joist, rafter, etc., is of steel instead of wood. The conventional spacing of 16 in. between centers in the wood house may be followed, or reduced to 12 in., or even expanded to 20 in. or even 24 in.—depending on the design.

Welded Lathing.

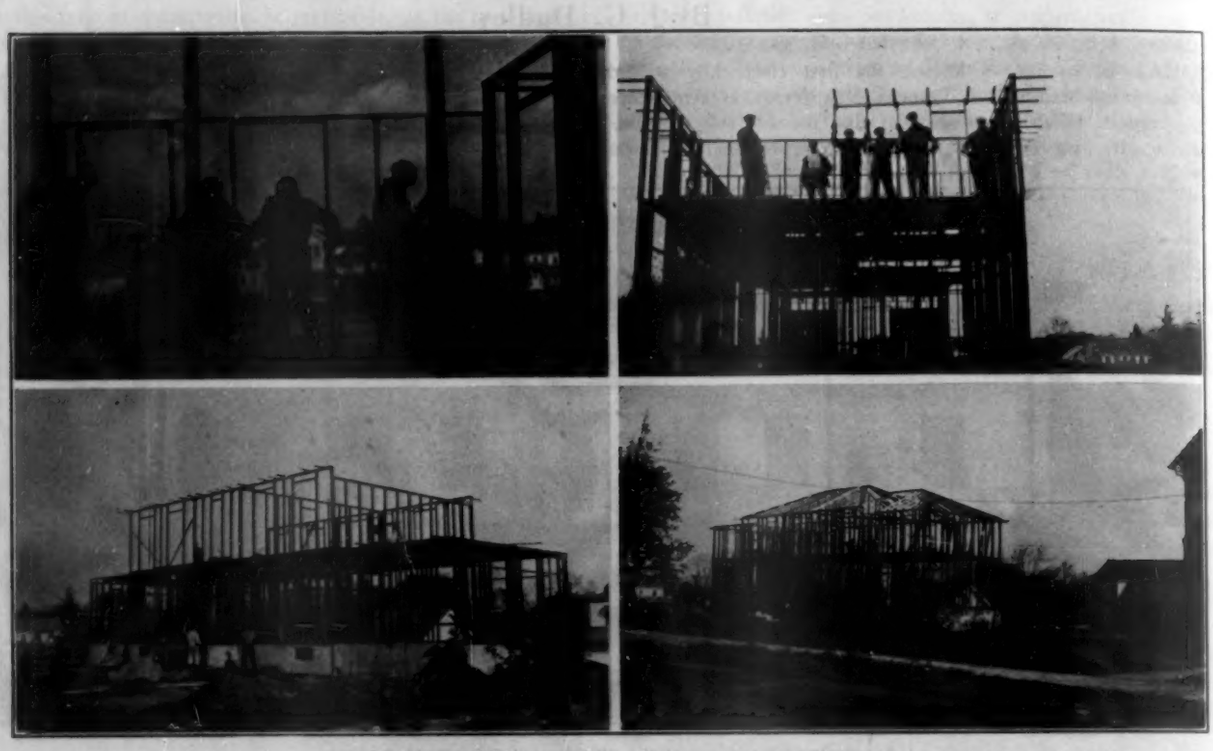
The steel shapes found to be best suited to this "Weldcrete" system are the well known "metal lumber" channels and "I"s of 3 in., 4 in., 5 in. and 6 in. sizes, all of approximately ⅛ in. thickness. The studs used were the 4 in. channels weighing but 1.85 lb. per ft., while the joists were 6 in. "I"s weighing 4.7 lbs. per ft. with the total weight working out at less than ¾ lb. per cu. ft. of building contents above foundations. Even this figure may, however, vary up or down, depending on the designer's selection of other variables.

All frame members were joined wholly by "tack" welds using the local power company's 220 volt, 60 cycle, single phase, alternating current stepped down through proper line transformers and the "Alternarc" welders to the usual 40 volt serving the operators.

From service pole to the farthest arc handled was approximately 150 ft. through cable suited therefor. Two welders and two helpers readily handled all welding, since all overhead work was entirely eliminated by special technique. Each weld required but a fraction of a minute to make, while the penetration in practically every weld was so good that many minutes strenuous work with cold chisel and machinist hammer were required to break a joint when once made. When the entire framing was

Prefabricating Panels.

completed the tack welds tying the structures together ran into the thousands, thereby resulting in an unitary and homogeneous building with all stresses and strains well distributed throughout the entire system. All static and dynamic loads are borne by the steel members themselves, thus wholly relieving the tack welds which mainly function in a manner identical with the flanges of the steel members by the author's system of "expansion nailing" and then applying thereto respectively: finish-slabs of reenforced, art-colored, waterproof portland cement motar for the floors and roof, or for the roof, with, preferably, color-blended asbestos-and-cement shingles, or slate, or even other less permanent but more economical equivalents.



Setting a Panel—Panel Erected—Frame and Flooring Finished—Skeleton Completed.

carpenter's nails in a wood house. Practically no weld is therefore subjected to shear, resulting in a building of maximum strength per pound of steel used.

The procedure followed in this house was to order all frame members "cut square and exact" at the mill—although this might even be done at the job when warranted. Hence, when assembled, no member had a single perforation for bolt or rivet for even temporary assembly purposes.

The walls and partitions were assembled from prefabricated "unit" panels of full story height afterward set into place and tied together by suitable tack welds.

The foundation footings comprise a reenforced concrete slab, which is also the basement floor, covering 100 per cent of the excavated area thereby making any settlement—save as a whole—an impossibility, thus insuring the framing and the sheathings against all strains and cracking which is so common from settlements of conventional methods.

As convincing evidence of the extraordinary strength of this system of skeleton construction: just prior to the framing of the roof, which obviously ties the building together, the structure successfully withstood a summer wind and rain storm of some 72 miles per hour for approximately an hour. All corrosion of the steel, after installation, is fully cared for by hermetically sealing it between inner and outer sheathing coats, thus preventing the conditions which might permit corrosion to take place at all.

Outer walls are preferably sheathed with metal lath rigidly secured to the studs and then coated with high grade, waterproof, art-colored-and-textured portland cement stucco, while all inner walls, partitions and ceilings can be satisfactorily treated with some of the excellent modern "wall-boards" finished with fireproof plaster. The rough flooring and roof sheathing can be successfully cared for by rough boarding secured to the

Tieing Panels.

Welded-steel casement windows, of special "awning" type, or other conventional substitute, were used throughout, giving a touch of unique beauty and also practical weather protection. The door and trim could be of welded or drawn sheet steel.

The stairs and horses are of steel with graceful iron balusters and art-colored composition treads and risers.

In such "Weldcrete" structures, comprising, as they do, building materials having very high heat conductivity, adequate insulation against heat and cold is of the utmost importance, hence this is provided for by proper selection of inside wall-boards and by hermetically sealing the hollow walls and roof and all doors and casements.

Provision is made for heating by the "shunt" system of (pressure) hot-water which costs no more than for steam or vapor systems and in addition saves fully 20 per cent in fuel operation, whether using coal, oil or gas.

Outstanding features of this "Weldcrete" house are its exceptional protection against earthquake, floods, lightning, tornadoes, corrosion, heat, cold, wind, moisture, settlement, cracking, ants, vermin, decay, depreciation, fire, repairs, insurance, etc.

These steel framed, electrically welded, stucco sheathed, incombustible "Weldcrete" houses should show annual savings sufficient to amortize their cost in from fifteen to twenty years.

(Note:—The author may be recalled as one of those primarily responsible for the creation of the Welding Committee of the Emergency Fleet during the World War. Mr. Dudley was a charter member of this committee and of the Research Committe. As head of the Research Department of the Harriman Shipyards during the war he was responsible for the redesigning of an 8,800-ton riveted freighter into its 9,300-ton counterpart. Mr. Dudley states that in his experience and investigations he knows of no serious try-out of welding as a substitute for riveting where the designer or maker ever reverted to riveting.—Editor.)

ECONOMY IN ARC WELDING PRACTICE

(The Welding Cables)

By Alexander Churchward*

It has always been the contention of the Wilson Welder and Metals Company that where approximately perfect welding was a requirement it was imperative that low current and a short arc be used. That is, not in excess of 150 amperes on butt welds and 175 on lap welds with 5/32" rod. This is still our contention, and is ably substantiated every day in important construction work.

It would seem almost unnecessary to dwell on the necessity of low current, but investigation has convinced us that the trend is toward speed in the deposition of metal, calling for the use of large electrodes and currents sufficiently heavy to fuse them, with a consequent detraction to the success of the weld.

We naturally receive reports of successful work and experiments with enthusiasm, but are often forced to look with suspicion upon tests made with high currents and large electrodes, not on account of the ability or lack of ability of the operators or investigators, but because of the fact that a great many tests so made which we have examined have proven that the excessive heat used has weakened the metal adjacent to the weld and thereby permitted the test pieces to break outside the weld.

Being of the above opinion, we were naturally exceedingly interested in the investigation of the trend of purchasers of electric arc welding machines toward high amperage on single operator units. That there is a use for these units in certain types of welding and production work is undeniable, and we feel that there are conditions where 3/16" and even ¼" electrodes can be used with profit and success. However, *we were amazed to find that in several places there was the impression prevalent, that reserve power in electric arc welding machines required amperage in excess of what was used in actual welding duty without reference to voltage.* Questions brought forth the fact *that this reserve ampere capacity was thought required to overcome the drop in the welding leads, when welding on work which was at a distance from the machine.*

In short, it seems that some users, we do not know how many, have in this case confused voltage and amperage.

If there is this opinion among operators and users of arc welding units, we think it well to emphasize the fact that *if the welding generator delivers 100 amperes at the generator it will deliver 100 amperes at the end of the welding leads, no matter how distant.* Loss in the welding leads is in the *form of volts, not amperes.* Therefore, the actual welding capacity of the arc at the end of the leads is consequent upon the length of that lead, and the ability of the welding generator to supply sufficient voltage to overcome the drop or absorption of said voltage, due to the resistance of the lead.

If we are right in our assumption, that the opinion as expressed above is a true reflection of opinion among the users and owners of electric arc welding units, and we reversed that opinion, then we feel that we will have effected economies for the industry, inasmuch as expenditures will not be required for high amperage capacity machines to do low amperage work because of such work being located at a distance from the welding unit.

This investigation then naturally led us to the welding leads themselves and here again from actual experience with companies doing a very great amount of welding we found almost a complete lack of interest in the economy and efficiency of the proper sized welding leads.

We therefore asked our engineering department to report on this condition, which report follows:

We are sure that where the lead question is not thoroughly understood this report will be of value.

Influence of Size of Leads on Welding and How It Affects the Size of Motor and Cost of Electrical Energy

On investigating many welding installations we find that proper regard is not given to the drop in the outgoing or welding electrode lead and even less to the return lead.

The return lead and connections must be just as good as the outgoing lead. The above applies to all cables carrying current independent of the make of the welding apparatus.

Because the ground connection is attached to a part of a building using a riveted structure, does not necessarily mean a good return circuit. The rivets are put in red hot and naturally there is a scale on the surface of the rivet when it cools off and that scale is more or less of an insulator, and as the current is comparatively high and the voltage available is comparatively low, the above combination calls for the best possible return. That is to say, the ground or return circuit is *good* when the voltage drop is not above the voltage drop of the outgoing or welding lead going to electrode handle, and it is *bad* when the drop is higher than that of the outgoing welding lead.

We will now approach the matter in another direction. How much does it cost in *dollars* not cents, to pay for a big drop in the leads.

We will take, for instance, a welding job 300 feet from machine; i. e., total conductor length 600 feet, 300 feet to the work and 300 feet return.

Take a welding current of 200 amps.

We will figure on No. 2 B. & S. (as that is the size we have found in use in a great many installations):

No. 2 B. & S. has a res. of .000156 ohms per ft. at 20 degrees C.

Therefore we have .000156×600=.0936 ohms for 600 ft. or .1 allowing for bolted connections.

.1 ohm at 200 amps.= 20 volts.

The voltage drop across arc will be approximately 20 volts.

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*Technical Director, Wilson Welder & Metals Co., Hoboken, N. J.

Therefore it will be readily seen that the drop across the 600 ft. #2 B. & S. leads is equal to the useful voltage available at the arc, and therefore the machine will have to generate 40 volts to give 20 volts at the arc.

40×200 amps.=8 KW at 80% eff. of generator=10 KW.

10 KW at generator will need a 13.5 hp. motor to drive generator.

Now if we use #00 in place of #2 B. & S., we will get the following results:

Resistance of #00 is just one-half of #2 B. & S. or .0000778 ohms per foot.

600 ft.×.0000778=.04668 ohms for 600 ft. or .05 allowed for bolted connection.

.05×200 amps=10 volts.

20 volts at arc and 10 volts drop on leads=30 volts total.

30 volts at 200 amps.=6 KW at 80% of generator=7.5 KW.

7.5 KW at generator will need a 10 HP motor to drive generator.

It will be seen from the above that there is a penalty of 3.5 HP continually being paid for day in and day out, if the small conductor is used; also if the set has a ten HP motor it will be overloaded continuously, approximately 35%.

If a gas engine driven set be used, the average gasoline consumption being 1 pt. per hour per HP hour, the penalty will be 3.5 pt.

To get at the actual cost we will figure electric current at 3c per KW hour, and gasoline at 25c per gallon and that the welding is approximately 70% of the time. Therefore the extra HP will be 3.5×70=2.45, say 2.5 HP and gasoline consumption 2.5 pints extra, when small conductor is used.

Welding 8 hrs. per day, 300 days per year=

2,400 hrs.×2.5 HP at 3c per KW hr.=$136.00 } extra per year

2400×2.5 pts. at 25c per gal. =$187.50 } of 2,400 hrs.

Cost per ft. of standard grade #2 B. & S. cable=13c

Cost per ft. of standard grade #00 cable =26c

or a difference of 13 cents per foot.

600 ft. at 13c=$78.

Therefore by the expenditure of $78 a saving of $136 per year can be made and the motor driving the welding set will not be overloaded.

The voltage drop on the 600 ft. will be 5 volts for the outgoing or welding lead cable and 5 volts for the return or ground cable. In many cases we have come across, the drop on the outgoing or welding lead was low, but the return to generator was high when riveted structural steel was used.

We will now suggest a method to check up the drop on welding lead and return.

(1) Short circuit the electrode holder on the spot where welding is to be done.

(2) Adjust rheostat on generator to give 200 amps.

(3) Read voltage at panel or if another voltmeter is handy measure the voltage drop at the switch. This will give the total drop on leads going and returning. If size of copper is known the drop can be easily calculated, and if it does not agree with the wire tables then look for some loose connections either where different lengths of cable are joined or where ground connection is made to the work such as on a large tank or riveted structure.

(4) If all joints are clean and tight (bad joint will show up by getting warm) and still the drop is excessive, as for instance on a large oil tank where the return is made through the riveted steel shell (for instance, #00 cable is used 300 ft. long and the drop at 200 amp. is 5 volts as it should be, but the total drop is 20 volts, then the return through the steel tank is 15 volts), it shows that the riveted joints are not making good electrical contact. Remedy would be to use #00 return and grounding near where the welding was being done.

(5) If another voltmeter is not handy, the following procedure can be used: Short circuit the machine at the outgoing terminals of main switch, adjust rheostat to get 200 amps and note voltage on voltmeter (A). Then short circuit electrode holder on work at the distant point, adjust machine for 200 amps. Note voltage (B).

B—A will be the true drop on leads.

When welding is done at great distances from generator, the copper should be increased so that a drop in voltage across both leads (going and returning) should not be over 10 volts. Below find a table giving greatest distance with standard commercial cable for 10 volts drop welding at 200 amps.

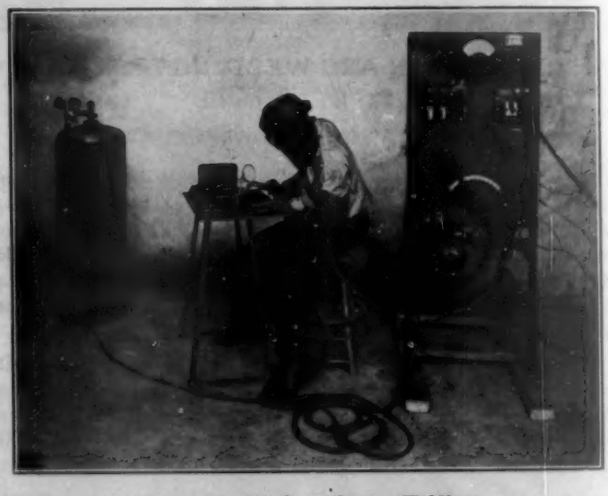
#2	B. & S.=	320 ft.	total=160 ft.	going and 160 ft. return
#1	B. & S.=	400 ft.	total=200 ft.	going and 200 ft. return
#0	=	500 ft.	total=250 ft.	going and 250 ft. return
#00	=	640 ft.	total=320 ft.	going and 320 ft. return
#000	=	800 ft.	total=400 ft.	going and 400 ft. return
#0000	=	1000 ft.	total=500 ft.	going and 500 ft. return

The above length of leads is based on bolted connections (when used) having the same conductivity as cable used.

ATOMIC HYDROGEN WELDING NOW MADE PRACTICABLE

Atomic hydrogen welding—the process by means of which hitherto unweldable metals can be melted and fused without the slightest trace of oxidation, and welding can be performed in some cases on metals as thin as the paper on which this is printed—is now made practicable by the use of equipment placed on the market by the General Electric Company. This process, making possible the welding of many special alloys and the production of ductile welds in iron and steel, is the result of research conducted by Dr. Irving Langmuir of the General Electric research laboratory.

In brief, this method utilizes the passage of a stream of hydrogen through the arc between two electrodes. The heat



Set-up for Atomic Hydrogen Welding.

of the arc breaks up the hydrogen molecules into atoms. These combine again a short distance beyond the arc into molecules of the gas, and in so doing liberate an enormous amount of heat, so that more effective welding temperatures can be obtained than with the usual welding methods.

Since atomic hydrogen is a powerful reducing agent, it reduces any oxides which might otherwise form on the surface of the metal. Alloys containing chromium, aluminum, silicon or manganese can thus be welded without fluxes and without surface oxidation.

Thorough trials, extending over a period of many months, were made in the General Electric shops before introducing the new equipment. The apparatus, as finally designed, represents the result of continued experimentation and research.

The welding outfit consists of the following: (1) a single-

phase transformer for converting the voltage of a 60-cycle source of power to one suitable for the welding equipment; (2) a specially designed, variable reactor to provide the proper welding current and voltage for different classes of work, and (3) the welding torch by means of which the actual work of welding is performed.

While the principle of operation is the same as that involved in the design announced by the General Electric research laboratory a year ago, the mechanical and electrical design has been much improved. The torch consists of a holder supporting two tungsten wire electrodes, the electric conductors connecting these electrodes to the reactor and the tubing for the hydrogen gas. Each electrode is supported inside a nozzle through which the hydrogen gas is forced out around the

Atomic Hydrogen Welding Torch.

electrode. The combination of electrodes and nozzles is set at an angle and the distance between electrodes, or arc length, and also the flow of gas, are readily adjustable.

The electric conductors to and through the torch are heavily insulated and, when welding ceases, the welding circuit is automatically interrupted until such time as the operator is ready to weld again, when the circuit is automatically restored. In contrast to the usual method of electric arc welding, there is no current flowing from the electrodes to the work to be welded. The circuit is completed from one electrode to the other.

The reactor consists of a "U"-shaped core provided with pole faces between which a pivoted armature is arranged to move. The legs of the core are provided with coils connected in series with the electrodes of the welding torch. The amount of welding current and voltage is governed by the movable armature which changes the air gap of the magnetic circuit and therefore the reactance. This armature is normally biased to an open position, and, upon a flow of current through the cells of the reactor, is attracted to a closed position that may be determined by means of a handle and a suitable mechanism. When the arc is struck the armature automatically assumes the closed position and remains there until welding ceases, when it automatically resumes the normal position of maximum air gap.

In making edge welds, the metal to be welded is melted under the heat of the arc but, when it is necessary to add additional metal, a filler rod must be used and fed into the arc in much the same manner as is followed in the ordinary gas welding process.

The new equipment is so far being marketed for operation from 60-cycle, single-phase circuits only, and is recommended for use on ordinary metals of less than ¼ inch in thickness, or on hitherto unweldable metals of greater thickness. Metals having a thickness of but 10 mils can easily be welded and little doubt is expressed that, in some cases, work as thin as 2 mils (about the thickness of ordinary writing paper) can be welded.

Because of the absence of oxides and nitrides from the weld made by this process, it is particularly adaptable to the welding of special alloys so far not weldable by other methods, and also makes a strong, smooth and ductile weld on ordinary iron and steel work. Inasmuch as pure chromium, nickel, copper, aluminum, silver and other metals and other alloys—not to mention iron and the more common metals—can be melted without oxidation, it is expected that new possibilities will be opened in such welding, although the field of application has been but partly studied.

SEMET-SOLVAY HAS LARGE ORDERS FOR WELDED EQUIPMENT

The Semet-Solvay Engineering Corporation of New York is receiving orders for welded equipment for a number of intesting new constructions. The Dixie Construction Co. has ordered a gas purifier entirely of welded steel construction with a manifold of welded steel for a plant at Holt, Alabama; and also a purifier 10x24x10 feet and a water cooler 2½x30 feet to be installed at Hattiesburg, Mississippi. This latter apparatus will take care of five hundred thousand cubic feet of gas every 24 hours under the present operating conditions. The Public Service Electrical Gas Company, of Camden, New Jersey, is having a steel purifier 25x32x14 feet made according to the standard Steere welded construction and connected to the plant system by a 20 inch manifold of welded steel. Pavilion Natural Gas Company, Pavilion, New York, who purchased a complete new Steere water gas generating plant early this year have ordered a second water gas machine, additional boiler capacities, feed water heater, wash box recirculation system and increased pumping apparatus. A large blower and connecting blast pipe, two exhaustors and considerable plant pipe will also be included. The gas piping will be of welded steel and most of the apparatus will also be of welded construction.

ORGANIZATION FORMED TO ASSIST WELDING OPERATORS AND EMPLOYERS

An organization of accredited gas and electric welding operators, "dedicated to the principles of higher standardization throughout the welding industry," has been formed by R. I. Scollard, C. E., with headquarters at Terre Haute, Indiana.

The purpose of the organization, The National Welding Engineers, is to assist and advance the individual operator, and to bring him to realize the direct and vital importance of his relationship to the industry as a whole. The rapid development of the welding art has created a demand for thoroughly competent operators that has exceeded the supply. To meet this demand, and to provide a system of standardization that will eliminate many causes of loss to both operator and employer, The National Welding Engineers renders a comprehensive service which should be invaluable to operator, expert, and employer.

The operator and expert is qualified, rated, and registered, on the basis of a comprehensive questionnaire and an actual test of his welds, performed by a large testing laboratory. An identification card is issued which contains the qualification, rating and data valuable to the owner when seeking a connection. He receives periodical data sheets covering important work being done. He is given free employment service, personal assistance by field experts, and laboratory research service at a minimum cost. Semi-annual district meetings and lectures by experts and leading industrial men are open to members of the organization. The cost of this service to operators is $10.00 with application and dues of $5.00 per year thereafter.

An encouraging response has come not only from operator members but from welding employers as well. This organization is doing a good work and deserves the cooperation of the industry.

NEW LINE OF FLUXES AND RODS

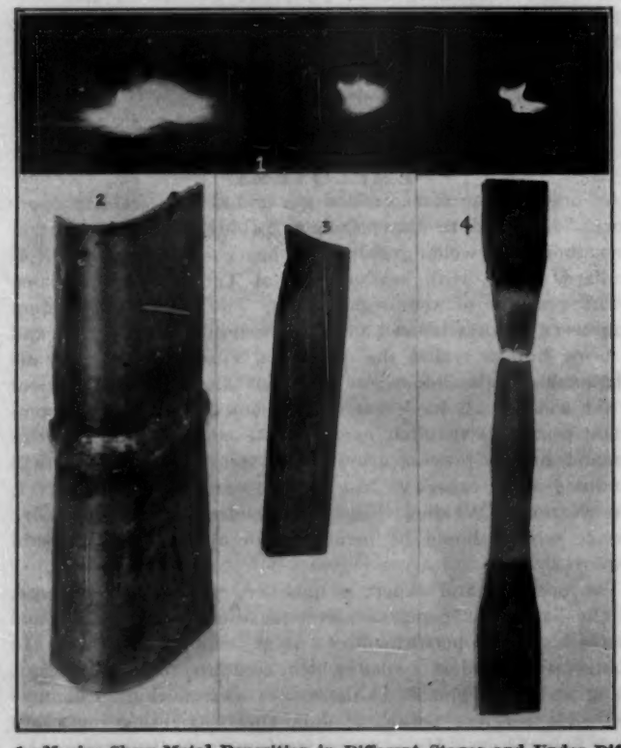
Krembs & Company of Chicago, exhibitors in Space 153-A at the Detroit exposition of the American Welding Society and the National Steel & Machine Tool Exposition will

have in charge of the booth several engineers and a competent metallurgist, who will be available not only to explain the methods of procedure and costs of the articles shown in the exhibit, but also to take up new methods and experimental work for manufacturers and their engineering staff.

Among the articles exhibited will be: Steel tubing brazed; cast iron welding; malleable welding and brazing; silver soldering; sheet aluminum; bronze welding. In connection with their line of specialized fluxes, they will also feature a new flux contained welding composition rod, which will be of much interest to those engaged in the art of brazing and welding. They are also demonstrating a new constructed furnace for brazing and also for case-hardening.

PREPARING NOVEL EXHIBIT FOR DETROIT SHOW

The Fusion Welding Corporation, an associate of the Chicago Steel and Wire Company, 103rd Street and Torrence Avene, Chicago, are planning a novel and quite extensive exhibit. In addition to a working exhibit of welding at its booth, a lecture hall in the main exposition building has been arranged for, and this will seat one hundred fifty people. In this lecture hall will be shown slow motion movies of both arc and oxy-acetylene welding taken with invisible infra-red light



1—Movies Show Metal Deposition in Different Stages and Under Different Conditions. 2—Test of Weld Made with High Ductility Electrode. 3—Weld Made with Self-Hardening Steel. 4—Test of Weld Made with Super- Strength Electrode Breaks Outside the Weld.

These pictures are all closeups of the welding action and enlarge the ordinary welding rod so that it shows several feet in diameter on the screen. In this way the actual transfer of metal in welding can be clearly seen, and due to the fact that infra-red light penetrates the haze always surrounding the welding action, far more can be seen than by the naked eye.

Extreme cases have been selected for these pictures so that the effects of the structure and chemical composition of the welding rod, together with the structure and composition of the surface materials, is plainly brought out showing the effect of each change on the welding operation.

In addition to these special motion pictures, a projection appartus has been developed which permits throwing the arc while in actual operation on the screen tremendously enlarged. This will give the audience an opportunity to request any special electrode to be run in actual welding in the lecture hall and see the work on the screen enlarged several hundred diameters.

At the booth in the convention hall will be exhibited the line of Weldite Welding Rods manufactured by the Chicago Steel and Wire Company. This line includes rods for both metallic arc, carbon arc and oxy-acetylene welding. Rods in operation will be shown for welding mild steel, high carbon steel, nickel steel and some alloy steels. In addition to these standard welding rods, there will be a large number of new electrodes which have been developed by the Research Department of the company and will be exhibited for the first time at Detroit. Photographs of results secured with some of these electrodes are shown in the accompanying illustration. One of these is a self hardening tool steel electrode Cutting edges can be readily applied with this electrode to mild steel. Often little more than a few drops of this electrode applied with the metallic arc will make a high speed tool out of a piece of ordinary mild steel. A special alloy electrode flux coated in such a way that metallic arc welds as ductile as rolled mild steel can be readily made is something entirely new.

Still another is called the "Super-Strength" electrode. A factor of safety is often required in welding mild steel. This super-strength electrode will regularly make welds stronger than mild steel.

The Fusion Welding Corporation covers a field not heretofore especially catered to by any other company. They offer free of charge a redesign engineering service in connection with welding and have for sale a full line of equipment and supplies for both metallic arc and oxy-acetylene welding. The company will be represented at Detroit at booth No. 168 by Mr. J. B. Green, President; Mr. F. B. Toombs, General Sales Manager; Mr. J. E. Wolcott, Cleveland District Manager; Mr. K. L. Hansen, Chief Engineer; Mr. J. J. Sacks, Service Engineer; Mr. R. W. Holt, Research Engineer.

NEW WELDING HANDBOOK ISSUED BY STOODY COMPANY

The Stoody Company, manufacturers of Welding Rod, Alloy Steels and Equipment, have just issued a new welding handbook the title of which is, "Stoody Products and their application to the Welding Industry in the Oil Fields."

The new book is literally a text-book on oil field welding. It tells the "hows" and "whys" of practically every type of welding common in oil field practice.

The opening section deals with the history of the Stoody Company and their products, telling of their research work in connection with the development of their present products.

One section is devoted entirely to the properties of Stoodite, believing that this information would prove of value to the welder and enable him to get the most out of Stoodite.

Perhaps the most interesting part of this new book which contains more than seventy-five pages and one hundred illustrations is the section titled, "Hard Facing and Reclaiming Oil Well Drilling Tools and Equipment." This section deals with the building up and Stooditing of Fishtails, Rotary Disc Bits, Underreamer Lugs, etc., also the building up of Reed Roller Bits, Hughes Cones, Zublin Cutters, Disc Bit Shanks and Rotary Tables. Explaining each step necessary to build up or reclaim and face the particular tool in question as well as progressive illustrations of how the work is done.

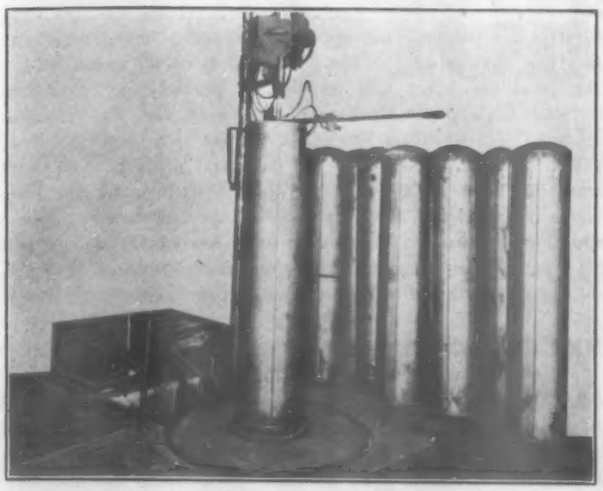
Copies of this book can be had gratis, by addressing the Stoody Company at their main office at Whittier, California or their branch at 732 East 12th Street, Oakland, California, or Stoody Products Sales Company, 220 East Brady, Tulsa. Oklahoma.

NEW AUTOMATIC BOTTOM WELDER FOR CYLINDRICAL TANKS

The accompanying illustration shows a new carbon arc automatic welding machine just placed on the market by the Lincoln Electric Company of Cleveland, Ohio. The equipment is designed for the purpose of welding bottom seams on cylindrical tanks. The application of the machine illustrated is on range boilers.

The equipment is standardized for tanks up to six feet in diameter and eight feet high. Special equipment may be furnished to handle any diameter or length of tank.

On 14 gauge material a lap head seam, as shown on the tanks



Automatic Welder for Round Tanks.

in the illustration, which have been welded at the rate of 135 feet per hour. The edge weld used on the bottom of some types of range boilers may be welded at the rate of 150 feet per hour, as the bottom is flanged and fitted so that the edges are together and flush with each other.

Tanks which are to have the bottom seams welded are set on the revolving table and the arm carrying the automatic welding head is adjusted to bring the arc on the seam. Speed of the revolving table is adjustable over a wide range to handle various sizes of tanks. Welding current is adjustable through the controls located on the welder control panel. The operator has automatic stop and start control on the automatic welder head. It is claimed that the equipment has general application in the tank field where large numbers of relatively small diameter tanks are built.

NEW SAFETY SPOT WELDING BOOTHS

Booths for the protection of spot welders have been adopted by the General Electric Company at its plant at Lynn, Mass.

Spot Welding Booths of Sheet Metal.

These booths are of sheet metal, with permanent side screens and portable back screens to control flying sparks.

Operators wear light weight goggles with leather side shields. There is actually little need for these precautions, as flying sparks (caused by an unclean surface on the metal) are rare. The wearing of gloves is optional on the part of the operators.

R. E. KINKEAD OPENS CONSULTING PRACTICE

Robert E. Kinkead has resigned as Chief Engineer, Welder Division of The Lincoln Electric Company of Cleveland, Ohio, to engage in Consulting Engineering in connection with electric arc welding. Mr. Kinkead's office is located at 3030 Euclid avenue, Cleveland, Ohio.

Starting early in the development of welding, Mr. Kinkead

R. E. Kinkead.

has become widely known among users of the arc welding process through his fourteen years of engineering work in the field. Upon graduation as a Mechanical Engineer, in Electrical Engineering, from Ohio State in 1913, he immediately joined The Lincoln Electric Company. A year later he had applied the inductive ballast principle or "stabilizer" to arc welders and had become Engineer of The Welding Department. In this capacity he served until 1917 when commissioned in the U. S. Navy. After the war he became Chief Engineer for The Mitchell Company, Chicago, Emergency Master Mechanics and Welding Contractors. After a short period as welding expert for The Western Electrical Company at the Hawthorne Plant in Chicago, he returned to The Lincoln Electric Company as Chief Engineer, Welder Division. In this capacity he has acted as Consultant to the many users of Lincoln Arc Welding equipment and has written a number of technical papers for trade publications.

Mr. Kinkead is a member of The Cleveland Engineering Society and The American Welding Society.

NATIONAL METAL WEEK

Some idea of the magnitude of the Ninth Annual National Steel and Machine Tool Exposition which will open in Detroit, September 19th, for a five-day display, can be gained from figures made public by W. H. Eisenman, secretary of the American Society for Steel Treating and manager of the exposition.

Displays set up by 300 exhibitors will occupy over 93,000 square feet of floor space and will require 3,000 horsepower to generate electricity for motors, furnaces and other apparatus to be shown in operation.

Current must be supplied in five different forms to cover all

needs. The huge convention hall will be wired for alternating current at 230 volts, sixty cycle, either single or three phase, and with alternating current at 115 volts. Direct current will be supplied at 240 and 120 volts.

Gas used daily to operate displays will total enough to supply the normal daily consumption of a city of 200,000 population.

Temperatures controlled in the exposition will vary from zero to 5,000 degrees Fahrenheit. Machinery and equipment on display will be worth well over a million dollars and will cost more than $700,000 to transport and install.

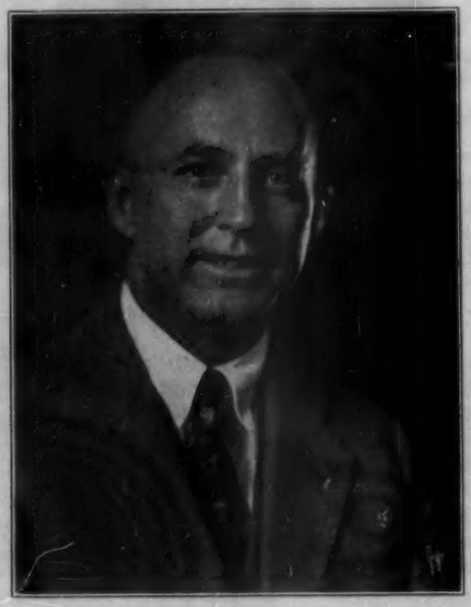
Represented at the exposition will be industries whose total capital investment runs to five billion dollars, whose annual production totals fifteen billion dollars, and employing more than a million men.

The pick of these men will be in Detroit during the expositoin for the meetings of the American Society for Steel Treating, Institute of Metals, Society of Automotive Engineers, and American Welding Society. More than 25,000 of the leading experts of the metals industries are expected to gather for the technical sessions of these groups, which will mark the greatest international exchange of technical information and ideas ever held in one city at one time.

To call attention to the importance to the metals industrial group of these meetings and the exposition, the week of September 19th has been proclaimed as National Metal Week

E. N. STEVENS JOINS REGO FORCE

E. N. Stevens, popularly known in the oxy-acetylene industry as "Steve" during his ten years' service on the sales force of the Imperial Brass Manufacturing Company, recently was appointed Assistant Sales Manager of the Bastian-Blessing Company, Chicago, Illinois, Welding Division. Mr. Stevens is particularly well known in the south west district, having spent several years in the oil fields by working with the Kansas City Oxygen Gas Company. He left the Imperial Brass Manufacturing Company



E. N. Stevens.

about a year ago and since that time has been a resident of Florida. A few weeks ago he returned to Chicago and accepted his new position with the Bastian-Blessing Company, where he will work with Mr. E. L. Mills, the Sales Manager, in extending the distribution of the Rego brand of oxy-acetylene equipment.

A GREAT SHOWING OF MECHANICAL AND POWER EQUIPMENT

The National Exposition of Power and Mechanical Engineering enters on its sixth year with glowing promises of overwhelming success. For five years this magnificent annual showing of mechanical and power equipment has measured the tremendous advances made in the United States in generating and using mechanical power for the increased well-being of its people. The sixth exposition, to be held December 5th to 10th, 1927, in the Grand Central Palace, New York, has already leased floor space equal to that of the show held in 1926, which occupied four floors of the Palace. Without question, therefore, every available square foot will be taken up by interesting showings of the latest mechanical devices for generating and using power in all types of industries.

The show is an all inclusive mechanical exhibition with excellent representations of heating and ventilating machinery, refrigeration apparatus, power transmission equipment, machine tools, measuring instruments, and apparatus as well as an all-embracing line of the devices used in the power plants of all industries.

As usual the Show will parallel the annual meetings of the American Society of Mechanical Engineers and the American Society of Refrigerating Engineers. These two meetings attract the leaders in the mechanical and industrial fields to New York during the week of the Show. The Show is under the management of Charles F. Roth and F. W. Payne of the International Exposition Company. These men have the advice and support of a committee of experts under the chairmanship of Irving E. Moultrop of the Edison Electric Illuminating Company of Boston.

AMERICAN STEEL & WIRE ISSUES WELDING ROD BOOKLET

The American Steel and Wire Company has recently issued a 24 page pocket size catalog covering their complete line of gas and electric welding rods, which are marketed under the trade name "Premier." In addition to showing the specifications of the different grades of wire the little booklet contains tables and charts showing the pounds of metal deposited per hour by the metallic arc bare low carbon rod, the piece work speed of welding with the metallic arc with a 60° single bevel, the piece work speed of welding with the metallic arc in a 60° double bevel, the pounds of metal built up per hour with hand operated carbon arc, the average speed of welding in a 90° single bevel with the gas torch and the average gas consumption in a 90° single bevel with the gas torch.

QUASI-ARC TO INCREASE SERVICE FACILITIES

The new offices of Quasi-Arc, Inc., now occupy enlarged quarters at 11 West 42nd St., New York City. Quasi-Arc electrodes and process, while known throughout the world generally, was up to recently presented in the United States only as a covered welding rod, with little technical backing or assistance. Recently, however, with the assistance of the parent company, a new company was formed, with Mr. H. L. Ammann, C.E., M.E., possessing very wide experience in the development of Quasi-Arc electrodes and products in European countries, in charge as Technical Director.

The process of fusion welding by means of the Quasi Arc electrodes is based upon the conviction that a successful weld depends on the application of metallurgical and scientific principles.

To produce an efficient weld, according to Quasi-Arc theory and practice, the following essential conditions must be observed:

1. The heat put into the work during welding must be so limited that it will not overheat and produce brittleness in the metal of the work.

2. The mill scale, etc., on the surface of the work must be cleaned away efficiently so that perfect fusion will be obtained between the weld metal and the metal of the work.

3. The atmospheric gases must be prevented from coming in contact with the molten metal.

4. The weld metal should be deposited under such conditions as to render its structure homogeneous and of a fine crystal grain, whereby a reliable joint of a high value of mechanical strength will be produced.

FREE Send coupon below for a free TOBIN BRONZE Welding Rod

See for yourself how

TOBIN BRONZE

REG. U. S. PAT. OFF.

WELDING

does better work and saves your time

TOBIN BRONZE
WELDED

Sample iron bars as illustrated above were cut in two, welded together with Tobin Bronze, and subjected to breaking tension. In every case the break occurred in the iron and not one sample cracked across the weld.

TOBIN BRONZE
is exclusively an
Anaconda Product

To be sure of getting uniformly dependable bronze rods for oxy-acetylene welding, look for the name Tobin Bronze stamped in the metal in every rod.

Believing the man who actually holds the torch to be the best judge of the materials he works with, The American Brass Company offers to send every interested welder a free sample length of Tobin Bronze, so that he can make a test weld, and observe the result for himself.

Take any small broken iron casting and weld it according to directions furnished with the sample Tobin Bronze welding rod sent you. Then clamp the welded casting in a vise and break it.

Note the low temperature at which it is possible to make a strong, perfect weld with Tobin Bronze. Also observe how the Tobin Bronze permeates the iron, giving it such strength that the casting, properly repaired, will never break at the weld.

This test will show you how Tobin Bronze saves both time and trouble in oxy-acetylene welding. Fill out and mail the attached coupon for your sample.

WE-12

THE AMERICAN BRASS COMPANY,
GENERAL OFFICES,
WATERBURY, CONNECTICUT.

Please send me a sample Tobin Bronze Welding Rod.

Name .....

Position .....

Firm .....

Address .....

Quasi-Arc electrodes are coated with a robust mineral flux having singular physical and chemical properties whereby a weld of high mechanical strength and purity is obtained.

This flux melts in a continuous flow from the electrode to the work, enclosing the arc, and, by reason of its special composition, protecting the weld metal during deposition from attack by the atmospheric gases, it also protects the metal during cooling so that a certain degree of annealing takes place. When cold the slag easily separates from the metal. It is also claimed by the manufacturers that the flux, being acid in character, thoroughly cleans and removes all mill scale and dirt from the work.

The electrode is said to require only a small current for fusion by reason of the low melting point of the flux, while its spiral application to the steel core ensures that the slag flows automatically over the metal, thus making welding a simple operation and one which can quickly be acquired by a novice.

KORO CORPORATION IN NEW PLANT

On the first of September the Lincoln Steel Company, formerly located at 229 West Illinois street, Chicago, changed its name to Koro Corporation and moved to a new plant at Waukegan, Illinois. The concern manufactures welding equipment, flux coated electric welding wire and flux coated gas welding bronze wire. Increased production for the company has forced it to seek larger quarters and the organization moved to Waukegan to secure the advantage

New Home of Karo

of being nearer to the source of supply of raw materials and having better shipping facilities. Plans for the enlargement of the present output of the company and the manufacture of additional products have been arranged. Officers of the company are: Harold M. Mattson, President, Mathias Mattsón, Vice President and Treasurer; A. I. Saavy, Secretary.

WILL SHOW SAMPLES OF BRAZED METAL PRODUCTS

Krembs & Company of Chicago will exihibit brazed and welded products at the Detroit exposition of the American Welding Society and the National Steel & Machine Tool Exposition.

In charge of the booth will be several engineers and a competent metallurgist, who will be available not only to explain the methods of procedure and costs of the articles shown in the exhibit, but also to take up new methods and experimental work for manufacturers and their engineering staff.

Among the articles exhibited will be steel tubing brazed, cast iron welding, malleable welding and brazing, silver soldering, sheet aluminum, bronze welding.

In connection with their line of specialized fluxes they will also feature a new flux contained welding composition rod, which will be of much interest to those engaged in the art of brazing and welding. They are also demonstrating a new constructed furnace for brazing and for case-hardening.

WELDING CONFERENCE AT MINNESOTA NEXT MONTH

A conference embracing all phases of the welding industry is to be held at the University of Minnesota on October 20th, 21st and 22nd, 1927, according to plans worked out by Professor S. C. Shipley, acting head of the Mechanical Engineering Department of the College of Engineering. This is the first conference of this nature held by the University of Minnesota, but according to the considerable interest shown by the users of welding equipment in the territory, the holding of such a conference promises to be a yearly event.

A large part is to be given to papers read by practical users as well as round table discussions led by experts in their respective lines.

TWO MINIATURE SHOPS IN THIS EXHIBIT

The exhibit of John A. Roebling's Sons Company at the Detroit Show, September 19-23, will be featured by two miniature shops, one showing the use of wire rope in heavy hoisting, and the other the use of welding wire in a locomotive shop. Those attending the exposition will include A. E. Gaynor and A. L. Miller, New York; E. T. Weart, Chicago; E. M. Dixon and E. King, Detroit; R. R. Newell, sales manager, of Cleveland; F. J. Mapel, advertising manager, and H. J. Horn, both of Trenton, N. J.

NEWS OF THE WELDING TRADE

Mr. A. M. Ross, formerly of the Wickwire Spencer Steel Corporation, recently accepted a position in charge of welding wire sales for the American Steel & Wire Company. Mr. Ross has had a thorough technical training and has spent ten years in the welding industry, so he brings to his new position a combination of enginering training and broad practical experience.

The Riverside Boiler & Welding Works, which was formerly located at Gainesville, Texas, recently moved their shop to Meunster, Texas, according to a recent report.

A new electric and acetylene welding shop will be in operation shortly at 104 North Broadway, Portland, Oregon, under the name of the Pallady Welding Works and under the management of Mr. H. A. Pallady. The new shop will occupy 2,500 square feet of floor space.

J. W. Meadowcroft, superintendent of the Edward G. Budd Manufacturing Company, who is well known to the welding industry for his many contributions to the development of welding in automobile manufacture, recently received a handsome service button from his company indicating that he has been with them for fifteen years of continuous service.

Mr. U. V. Westover recently joined the welding wire department of the Wickwire Spencer Steel Company, 41 East 42nd Street, New York City. Mr. Westover's previous connection was with the National Malleable Castings Company.

The Wilson Welder & Metals Company have reproduced in booklet form an article entitled "Economy Effected by Arc Welding Practice," by T. E. DePew, which appeared in a recent issue of *The Welding Engineer* and describes the welding in the New York Edison East River Station.

W. G. Swaney, Kerotest Manufacturing Company of Pittsburgh, spent the past two months in an extended trip through the oil fields of the South and Far West.

To Start a Welding Job Right
USE A WODACK

To prepare a weld so that it is easy to get penetration, and so that the weld will be clean; and also to finish the job so that it will take a smooth coat of paint—use a WODACK Combination Electric Drill and Grinder. This tool is recommended for welders because it gives two tools in one, with one motor. Our booklet, "Electric Tool Facts," tells how it is serving other welders. Send for your copy.

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Combination Portable
Electric Drill and Grinder
Patented Nov. 1, 1921

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10 So. 18 St., Philadelphia
601 Granite Bldg., Pittsburgh

GE Arc Welders, GE Electrodes: TYPES A, B and F
GE Welding Accessories: Handshields, Helmets, Electrode Holders, Cable, etc.
Page-Armco Welding Wire and Electrodes
Write to nearest office for descriptive circular and prices

Classified Ads

Help Wanted—75c per line, minimum 4 lines.
Jobs Wanted—4 lines free.
Other Ads—$1.00 per line, minimum 4 lines.
Counted 8 words to line. Add 6 words for keyed address

Position Wanted—A man with many years' experience as service supervisor for a large manufacturer in the oxy-acetylene field desires position involving sales or service work that does not require much travel, or as supervisor of large welding department where there is opportunity for increased earning power. Address 127, care The Welding Engineer.

Wanted—The address of every gas and electric welder in the United States. Send them to Knight Brothers, 113 S. Oakley St., Chicago, Ill.

For Sale—Service rights on W. K. and W. C. Prest-O-Lite Cylinders, large or small quantities. Alfred E. Corp., 40 Mathewson St., Providence, R. I.

For Sale—One Norwalk 10¼x12 four stage compressor, 5,000 pounds per square inch. Good condition $750.00. One oil trap $30.00. Caustic cylinders $25.00. Also quantity of copper tubing. Box 331, Coraopolis, Pa.

Position Wanted—Thoroughly experienced oxy-acetylene welder, graduate of Technologie of Dresden and Kiel, Germany. Twelve years practical experience. Served as welding instructor in technical schools. Sales and service engineer for one of largest manufacturers in Germany. Holds patents on welding apparatus. Desires connection with American manufacturer. Reinhold Richter, 1834 Broadway, Schenectady, New York.

REBUILT ELECTRIC WELDERS

We furnish you with a dependable rebuilt welding machine service. Every rebuilt machine is guaranteed.

We also furnish new machines of all standard makes.

We will purchase your old machine or accept it as part payment on a new welder.

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Many Others—WRITE.
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FOR THE OXY ACETYLENE WELDER
$1.00
ALL STEEL WIRE BRUSHES
SEND $1.00 FOR 5 ASSORTED BRUSHES
Money refunded on return of goods, if not what you want.
WRITE FOR DEALERS' PRICES
C. SORENSEN, 18 E. 16th ST., CHICAGO

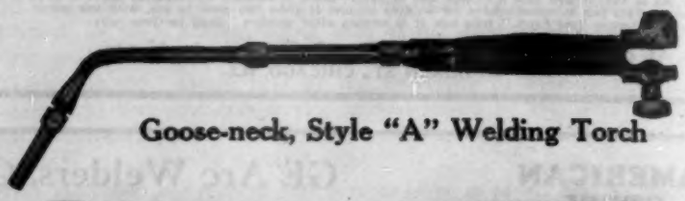
"STANDARD"
Welding Wire
GAS AND ELECTRIC
A grade for each type of work—send for samples.

for sound permanent welds : : lower costs
Our costs are considerably under those of large industrial centers; ours is a one-profit wire sold direct to user from our own mills exclusively devoted to making of welding wire from raw material to finished product—hence our extremely low prices for wire that is definitely superior. Adopted exclusively by many large users.
Prices on request.
Standard Steel & Wire Co., Greensburg, Pa. (Mills at Bolivar, Pa.)

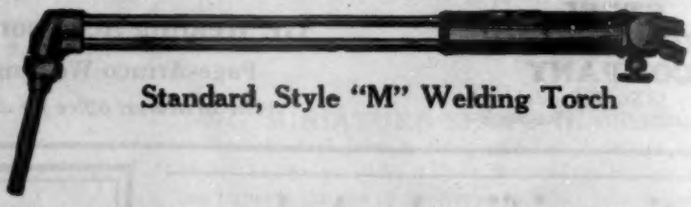
Users call it, "THAT GOOD K-G TORCH"

Order "that Good K-G Torch" from the nearest dealer listed below.

Weldit Acetylene Co., 638 Bagley Ave., Detroit, Mich.
A. G. Sprague, 276 Davidson Ave., Perth Amboy, N. J.
Sight Feed Generator Co., West Alexandria, Ohio.
Welders Service Co., 229 Second Ave., Pittsburgh, Pa.
Passaic-Bergen Welding Works, 659 Main Ave., Clifton, N. J.
Passaic-Bergen Welding Works, 356 Fair St., Paterson, N. J.
Sutton-Garten Co., 217 W. 10th St., Indianapolis, Ind.
The Service Welding & Supply Co., 500 N. Park St., Columbus, Ohio.
The J. L. White Company, 16 Brown St., Waterbury, Conn.
Chicago Grinding & Machine Co., 2117 Tilden St., Chicago, Ill.
Motor Accessories Co., 1041 Hamilton St., Allentown, Pa.
Harry P. Winslow, 35 Vinton St., Worcester, Mass.
Wisconsin Motor Parts Co., 2446 Prairie Ave., Chicago, Ill.
Welders Supply Co., 700 McCulloch St., Baltimore, Md.
J. W. Evans Sons, 95 Brook St., Thompkinsville, Staten Island, N. Y.
Albany Welding & Boiler Works, 40 Madison Ave., Albany, N. Y.
H. Harrison Kross, 1718 Sansom St., Philadelphia, Pa.
Welding & Supplies Co., 3445 Parthenais St., Montreal, Can.
Welding & Supplies Co., Toronto, Can.
E. Brass Auto Supply Co., 307 Burnet St., New Brunswick, N. J.



Goose-neck, Style "A" Welding Torch



Standard, Style "M" Welding Torch

The extreme simplicity of the K-G welding torch combined with the scientifically correct principles of mixing of the gases in exactly correct proportions to make a neutral flame which will not contain too much of either gas, is what makes this welding torch the best yet produced.

K-G WELDING & CUTTING CO., INC.
515 W. 29th St.
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The Quality Is Not Allowed to Vary

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BEST for All Industrial Purposes

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*Plants

JUST as Burdett plants are noted for the uniformly high purity of their oxygen, so Burdett representatives are known for the high quality of their service to oxygen users. Consult them freely. It is our desire to be of real help to welders and cutters, in getting the best of results, with all waste motion and unnecessary expense eliminated.

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of Superior Quality
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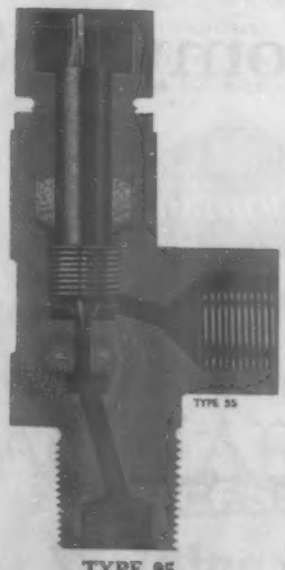
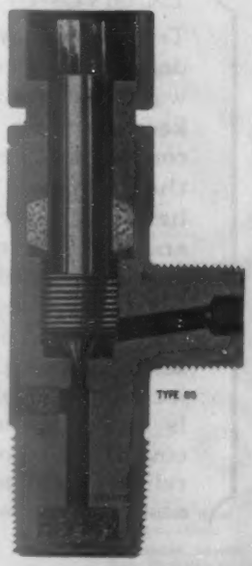


TYPE 95
Presto O Lite Outlet



TYPE 98
Commercial Outlet

Weldite

Welding Rod

Weldite G—No. 6 Coppered Finish for gas welding lays the metal down quietly, free from boiling, free from surface scum and floating white specks. The metal settles instantly when the torch is removed.

Weldite E—No. 18 Green Surfaced for electric welding is the smoothest running electrode ever offered users of welding. Sold at the price of bare electrodes.

See our exhibit National Steel & Machine Tool Exposition DETROIT Convention Hall Booth

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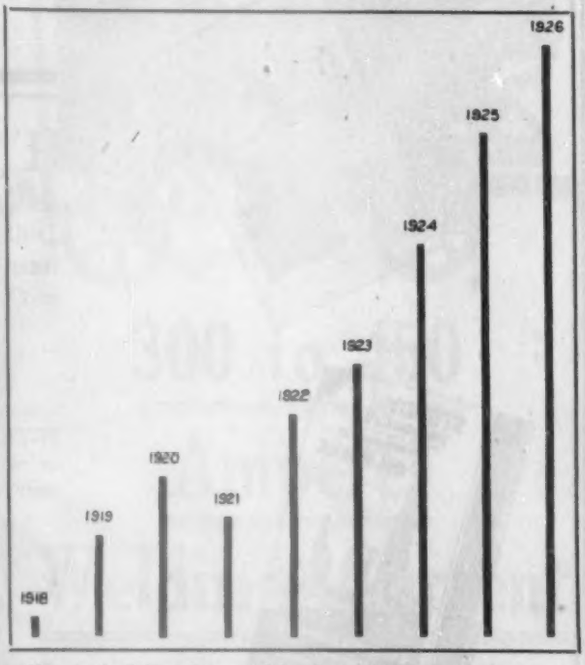

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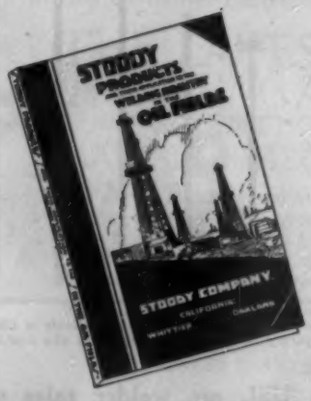

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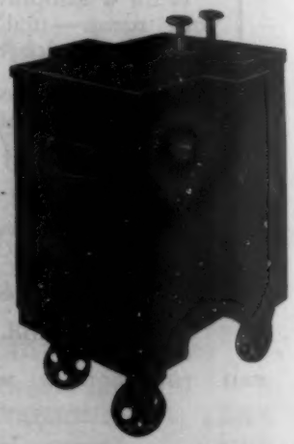

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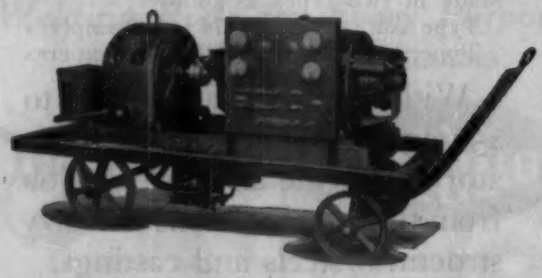

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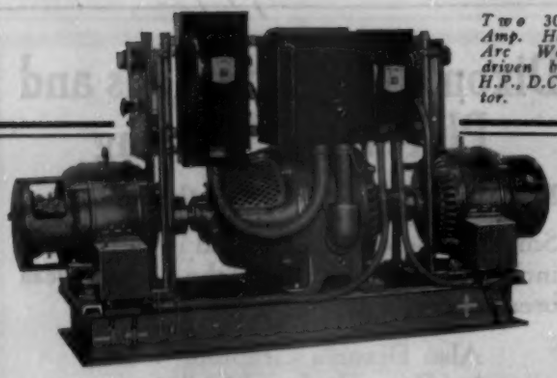

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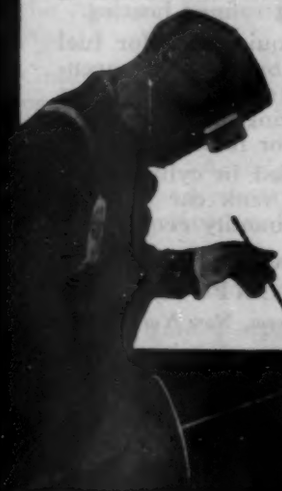

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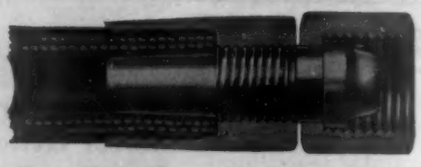

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